

P-W

Lockhart #1 (K-W) Aztec #1
NE/4-SE/4 Sec 33-Twp 14N-R 20E 93

HA-1 (2/2/68)

REPORT OF ANALYSIS

F. S. - 11518 M.S. N-39694 ,H .30 OBS. PRES. 66.5 CAL. PRES. 65.6
STATE- ARIZONA COUNTY- NAVAJO
FIELD- WILDCAT WELL NAME- LOCKHART AZTEC NO. 1
LOCATION- SEC. 33, T14N, R20E OWNER- ARK-LA EXPLORATION CO.
DATE COMPLETED- 06/03/63⁴⁹ DATE SAMPLED- 3734
SAMPLED BY- LOREN HUGHES
NAME OF PRODUCING FORMATION-
DEPTH IN FEET- THICKNESS IN FEET-
SHUT IN WELLHEAD PRES., PSIG- OPEN FLOW, MCF/D-

CHECK OF DATA-
THE WELL DATA ARE ACCURATE, () WITHOUT CORRECTION, () AS CORRECTED ABOVE.

REMARKS-

ANALYSIS-

METHANE	24.6 %	NORMAL PENTANE	.1 %	OXYGEN	0.0 %
ETHANE	3.2 %	ISOPENTANE	0.0 %	ARGON	.1 %
PROPANE	1.5 %	CYCLOPENTANE	TRACE %	HYDROGEN	.1 %
NORMAL BUTANE	.3 %	HEXANES PLUS	.1 %	H2S	0.0 %
ISOBUTANE	.2 %	NITROGEN	69.6 %	CO2	TRACE %
SPECIFIC GRAV	.884			HELIUM	.28 %
				TOTAL	100.1 %

CALCULATED GROSS BTU/CU. FT., DRY AT 60 DEG. F AND 30 IN. MERCURY- 372.

PERMISSION FOR RELEASE:

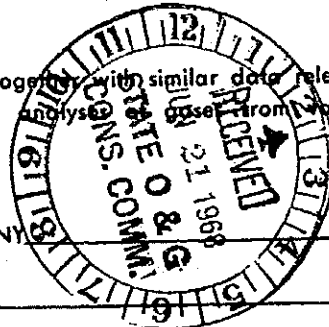
Permission is hereby granted for the Bureau of Mines to release the above data, together with similar data released by other operators as public information and as parts of a series of papers on analyses of gases from various fields, states, or regions.

*Apparently gas was sampled
from 1435-1735'*

COMPANY

BY

TITLE



HA 1 (2/2/68)

REPORT OF ANALYSIS

F. S. - 11518 M.S. N-39694 ,H .30 OBS. PRES. 66.5 CAL. PRES. 65.6

STATE- ARIZONA

COUNTY- NAVAJO

FIELD- WILDCAT

WELL NAME- LOCKHART AZTEC NO. 1

LOCATION- SEC. 33, T14N, R20E

OWNER- ARK-LA EXPLORATION CO.

DATE COMPLETED- 06/03/63 6-3-49

DATE SAMPLED- 3734

SAMPLED BY- LOREN HUGHES

NAME OF PRODUCING FORMATION-

DEPTH IN FEET-

THICKNESS IN FEET-

SHUT IN WELLHEAD PRES., PSIG-

OPEN FLOW, MCF/D-

CHECK OF DATA-
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REMARKS-

ANALYSIS-

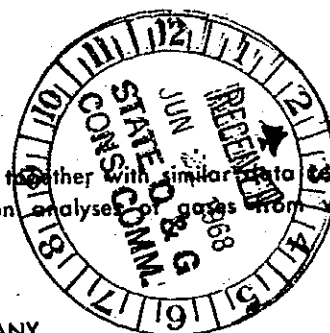
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				TOTAL	100.1 %

372.

CALCULATED GROSS BTU/CU. FT., DRY AT 60 DEG. F AND 30 IN. MERCURY-

PERMISSION FOR RELEASE:

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COMPANY

BY

TITLE

HA-1 Revised 6-26-58

REPORT OF ANALYSIS

State Arizona F.S. No. 8670
County Navajo Field _____
Well Owner Astec Land & Cattle Co. Name L. M. Lockhart No. 1
Location: Sec. 33 T. 14N R. 20E Date Completed _____
Open Flow MCF/D Wellhead Pressure p.s.i.g. _____

Producing Stratum:

Depth to (feet): _____ Thickness (feet): _____

Stratigraphic Position of Producing Formation _____

Sampled: Date: _____ By: _____

Mass Spectrometer Run No. 7766 Date of Run 10/3/62

Analysis:

Methane	23.8	%	Normal Pentane	Trace	%	Oxygen	Trace	%
Ethane	3.2	%	Isopentane	0.1	%	Argon	0.1	%
Propane	1.1	%	Cyclopentane	Trace	%	Helium	0.267	%
Normal Butane	0.3	%	Hexanes Plus	0.1	%	Hydrogen	0.0	%
Isobutane	0.3	%	Nitrogen	70.7	%	H ₂ S	0.1	%
						CO ₂	0.1	%

Calculated gross B.t.u./cu. ft., dry at 60°F. and 30" mercury 357 Total

CHECK OF DATA: The well data are accurate:
() Without correction () As corrected above

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Company _____

By _____

Title _____

Form 10433

Rev. 7-13-49

HA-1 Revised 6-26-58

REPORT OF ANALYSIS

State Arizona

F.S. No. 8670

County Navajo

Field _____

Well Owner Astos Land & Cattle Co.

Name L. M. Lockhart No. 1

Location: Sec. 33 T. 14N R. 20E

Date Completed _____

Open Flow MCV/D

Wellhead Pressure p.s.i.g. _____

Producing Stratum:

Depth to (feet): _____

Thickness (feet): _____

Stratigraphic Position of Producing Formation _____

Sampled: Date: _____

By: _____

Mass Spectrometer Run No. 7766

Date of Run 10/3/62

Analysis:

Methane	23.8	%	Normal Pentane	Trace	%	Oxygen	Trace	%
Ethane	3.2	%	Isopentane	0.1	%	Argon	0.1	%
Propane	1.1	%	Cyclopentane	Trace	%	Helium	0.267	%
Normal Butane	0.3	%	Hexanes Plus	0.1	%	Hydrogen	0.0	%
Isobutane	0.3	%	Nitrogen	70.7	%	H ₂ S	0.1	%
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Company _____

By _____

Title _____

Form 10433
Rev. 7-13-49

HA-1 Revised 6-26-58

REPORT OF ANALYSIS

State Arizona F.S. No. 8670
County Navajo Field _____
Well Owner Aztec Land & Cattle Co. Name L. M. Lockhart No. 1
Location: Sec. 33 T. 14N R. 20E Date Completed _____
Open Flow MCF/D Wellhead Pressure p.s.i.g. _____

Producing Stratum:

Depth to (feet): _____ Thickness (feet): _____

Stratigraphic Position of Producing Formation _____

Sampled: Date: _____ By: _____

Mass Spectrometer Run No. 7766 Date of Run 10/3/62

Analysis:

Methane	<u>23.8</u>	<u>%</u>	Normal Pentane	<u>Trace</u>	<u>%</u>	Oxygen	<u>Trace</u>	<u>%</u>
Ethane	<u>3.2</u>	<u>%</u>	Isopentane	<u>0.1</u>	<u>%</u>	Argon	<u>0.1</u>	<u>%</u>
Propane	<u>1.1</u>	<u>%</u>	Cyclopentane	<u>Trace</u>	<u>%</u>	Helium	<u>0.267</u>	<u>%</u>
Normal Butane	<u>0.3</u>	<u>%</u>	Hexanes Plus	<u>0.1</u>	<u>%</u>	Hydrogen	<u>0.0</u>	<u>%</u>
Isobutane	<u>0.3</u>	<u>%</u>	Nitrogen	<u>70.7</u>	<u>%</u>	H ₂ S	<u>0.1</u>	<u>%</u>
						CO ₂	<u>0.1</u>	<u>%</u>

Calculated gross B.t.u./cu. ft., dry at 60°F. and 30" mercury 357 Total

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Company _____

Form 10433
Rev. 7-13-49

By _____

Title _____

HA-1 Revised 6-26-58

REPORT OF ANALYSIS

State Arizona

F.S. No. 8670

County Navajo

Field _____

Well Owner Aster Land & Cattle Co.

Name L. M. Lockhart No. 1

Location: Sec. 33 T. 14N R. 20E

Date Completed _____

Open Flow MCF/D

Wellhead Pressure p.s.i.g. _____

Producing Stratum:

Depth to (feet): _____

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By: _____

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Date of Run 10/3/62

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Methane	23.8	%	Normal Pentane	Trace	%	Oxygen	Trace	%
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Company _____

By _____

Title _____



Division of Helium
Reserves

UNITED STATES
DEPARTMENT OF THE INTERIOR

BUREAU OF MINES
HELIUM ACTIVITY

October 8, 1962

714 BARFIELD BUILDING
AMARILLO, TEXAS

Mr. John E. Petty, Petroleum Geologist
Oil & Gas Conservation Commission
State of Arizona
1900 North Central
Phoenix 12, Arizona

Dear Mr. Petty:

Enclosed are two copies of a report on the analysis of a gas sample which was analyzed as a part of the Bureau of Mines survey for helium-bearing natural gases. This sample was obtained from your L. M. Lockhart No. 1 well located in Section 33, Township 14 North, Range 20 East, Navajo County, Arizona.

The Bureau of Mines plans to publish a series of papers on the analyses of gases from the various states and would like to obtain a release of the enclosed data for publication with similar data released by other operators. It will be appreciated if the owner of the well from which this sample was obtained, or his representative, will sign the "Permission for Publication" on one copy of the report and return it to us. A self-addressed stamped envelope is enclosed. If the owner desires permission to publish or circulate the analytical results, please communicate directly with the Director, Bureau of Mines, Washington, D.C.

To be sure that the well data are accurate, please check the information on the report of analysis and indicate in the appropriate square whether they are accurate without correction or as corrected on the sheet. If the data sheet is not complete, please supply the missing information.

We wish to thank you for your cooperation in furnishing us with samples of gas for analysis.

Sincerely yours,

R. D. Munerlyn
Chief, Branch of Engineering

Enclosures 2



Division of Helium
Resources

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
HELIUM ACTIVITY

October 8, 1962

814 BANFIELD BUILDING
AMARILLO, TEXAS

Mr. John K. Petty, Petroleum Geologist
Oil & Gas Conservation Commission
State of Arizona
1300 North Central
Phoenix 12, Arizona

Dear Mr. Petty:

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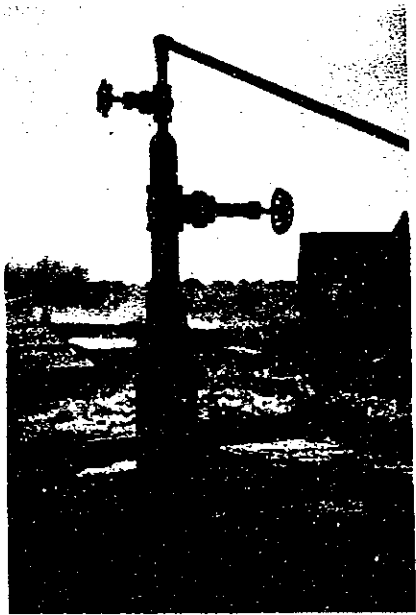
Sincerely yours,

R. B. Munerlyn
Chief, Branch of Engineering

Enclosures 2



Lynn Lockhart #1 Aztec SE Sec. 33-T14N-
-R20E Navajo Co. The sample of gas being
taken is being tested by U.S. Bureau of Mines.
9 miles W- Snowflake. Aug. 1962 *Alpha*



K.W. (Lockhart) # 1 Aztec

Sec. 33 - T. 14N., R. 20E.

Navajo County, Arizona

Circa March 1951

ARIZONA STATE LAND DEPARTMENT

Lessee's Monthly Report of Operations

 Lease or
Permit No. 19313

*No reports for
rest of year.*

K-W (Lockhart) - Aztec #1

 The following is a correct report of operations and production (including drilling and producing wells)
for the month of August 1950

 Agent's Address 214 N. Central Ave. Company K-W Oil Co.
Phoenix, Arizona Signed
Telephone 4-2156 Agent's Title Secretary

Section and 1/4 of 1/4	Township	Range	Days Produced	Barrels of Oil	Gravity	Cubic Feet of Gas (in Thousands)	Gallons of Gasoline	Barrels of Water (if None so State)	Remarks (if drilling, depth; if shutdown, cause; date and result of test for gasoline content of gas)
NE-SE Sec. 33	14N.	20E.,	Navajo County, Arizona.						
August:	August 3, U. S. Glycerine Co. placed 135 additional quarts on top of 400 quarts remaining in hole and detonated complete charge. Cleaned out to 1735' August 14th. Hole cleaned out and dried 8" casing to 1528'. Making continuous flow. Pressure (8 to 10#) to square inch of "Sweet" inflammable gas, burns with clear blue flame. Since shooting on August 3rd, the water level drops over night from the surface to 1300'. From 1300' the hole can be bailed out in 2 hours. From 1528 to 1635 ft. it takes 36 hours of continuous bailing with 12 round trips per hour at 47 gallons per trip estimated at 20,000 gallons, to clean out the hole from 1528' to 1635'. From 1635' to 1735' the hole can be bailed dry in 3 hours. It is suspected that the maximum effect of the shot was concentrated in the salt section between 1528' to 1635' without too much effect on the limestone from 1635' to 1735'.								

 NOTE:—There were runs or sales of oil; runs or sales of gas;
runs or sales of gasoline during the month. (Write "no" where applicable.)

NOTE:—Report on this form is required for each calendar month, regardless of the status of operations, and must be filed in triplicate with the Commissioner by the 6th of the succeeding month, unless otherwise directed by the Commissioner.

Approved:

 W.H. - 15 Sep 50
Date

K-W Oil Co.

 By W.H. Weast
Company
Title Secretary

 214 N. Central Ave., Phoenix, Arizona
Address

No permit

copy
O. A. LARRAZOLO, JR.
Petroleum Geologist
Phone 2-8459 254 Korber Bldg.
Albuquerque, N. M.

September 6, 1949

Mr. W. H. Weast
513 W. Latham St.,
Phoenix, Arizona.

Dear Sir:

Pursuant to your request made through Mr. D. M. Ferebee, of the Stanolind Oil and Gas Co., I went to Winslow, Arizona on August 28th., and there, through the courtesy of Mr. Ferebee, examined cores, logs, laboratory tests, etc., from the Lockhart No. 1 Aztec well drilled in section 33 T 14 N R 20 E., Navajo County, Arizona. I returned to Albuquerque the same afternoon bringing with me all the documentary evidence concerning the well which was kindly furnished me by Mr. Ferebee.

Although time has not permitted an examination of the area in which the well was drilled it is evident from structure maps and regional geology that the test was drilled on adequate geological structure. The stratigraphy of the area as described by Mr. Charles S. Lavington in his report of the region and by Mr. Ferebee personally to me, coupled with the structural features as mapped, certainly merited the test. The results of the Lockhart No. 1 well amply confirmed the opinions of these two gentlemen.

The well started in the Coconino sandstone of Permian age. The succeeding underlying formations were topped at the following depths:

Supai formation	550 ft.
Fort Apache Zone of Upper Supai	
(from samples)	1540 "
(from Electric Log)	1520 "
Bottom Fort Apache	1750 "
Middle Supai	2160 "
Lower Supai	2480 "
Intra-formational conglomerate	3015 to 3024 ft.
Pennsylvanian formation	3024 ft.
Mississippian	3650 "
Devonian	3685 "
Total Depth	3734 "

It is hardly necessary to describe the log of the well in detail. The important features of the well are the zones which the core analyses, electric log, solubility tests, etc., are worthy of further treatment to test the possibility of oil and gas production.

There are three potential oil and gas horizons indicated by these tests, as follows:

9-3

Zone 1. The electric log picked up the top of the Fort Apache zone of the upper Supai formation at 1520 ft. from 1520 feet to 1628 feet the cuttings showed oil stains- this section was not cored. From 1678 to 1741, a thickness of 63 feet, the section was cored and a core recovery of 100% was obtained. The core analysis of this section, copy of which you have, shows a dolomitic limestone with a weighted average porosity of 3.5%, average oil saturation of 32.6% and 70% solubility in acid. Permeability tests indicated a high capacity of the section.

Zone 2. From 3150 to 3600 feet there is a zone the upper part of which consists of lime showing only minor fractures with local zones of saturation. From 3452 to 3513 feet laboratory tests indicate a saturation of from 0 to 12.8% and a solubility in acid of from 57% to 92%, with an average of 70%. From 3513 to 3600 feet alternating shales, limestones and sandstones show minor fracturing and a small saturation in the cores.

The whole zone, an aggregate of 400 feet, may be worth a test in future wells if contemplated tests in the Lockhart No 1 well are successful. In this well however, the zone does not seem of enough importance to justify the cost of a thorough test.

Zone 3. from 3610 to 3640 feet a brecciated, hard, red, gritty conglomerate, in which no core recovery was obtained, may contain major fracturing.

From 3657 to 3685 feet the core analysis shows continuous oil saturation ranging from 3.6% to 41.4% and a solubility in acid of from 76.5% to 89.5%. Effective porosity of this zone ranges from 1.1% to 5.5% and major fracturing is plainly visible.

From 3685 to a depth of 3708 feet core analyses indicate oil saturation of from 0 to 14.5% with a weighted average of 9.6%; solubility in acid of from 38.9% to 89.4% and the greater portion of the zone averaging better than 74.3%.

The high porosity and saturation indicated by core analyses in zones 1 and 3, together with the high solubility of the formations in each zone and the presence of major fractures give these two zones a high potential value as oil and gas horizons. With modern methods of well completion and development no well having the indications shown by this well should be abandoned without a proper treatment with acid and, as indicated in this case, implemented by shooting to loosen the formation and make it more susceptible to acid.

From the foregoing facts it is obvious that acidizing offers excellent possibilities of developing commercial production of oil and gas in at least two horizons in the Lockhart No. 1 well. It is therefore recommended that after drilling out the plug and cleaning the well the following steps be taken:

Zone 3.

It is suggested that 5½ inch casing be set at 3605 feet and cemented with at least 250 sacks of cement and preferably 300 sacks. It is then desirable to shoot the formation with 250 quarts of nitro-glycerine. The well should then be thoroughly cleaned out and a production test made. If the shot fails to develop commercial production of oil or gas it will serve to form lines of fracturing in a deep zone surrounding the bore hole which will permit the acid penetrate deeper. This should be applied in

at least two and preferably three stages. The first should be no more than 1000 gallons. After that the well should be thoroughly cleaned out and a production test made. The second stage should be with 3000 gallons. If a third stage is necessary then 10,000 gallons should be applied, cleaned out and tested.

Zone 1.

This zone, from 1520 to 1741 feet, is also a most attractive one. If zone 3 should fail to develop into a commercial zone after acid treatment the same procedure should be followed with zone 1.

After recovering as much casing as possible above the cemented section a bridge plug should be set at 1750 feet. The casing should be set at 1520 feet and cemented with 250 sacks of cement. There will then remain 230 feet of open hole which should be shot with 350 quarts of nitro-glycerine, cleaned out and tested. If results are negative or unsatisfactory then a three stage acid treatment should be applied with the first stage being 1000 gallons; the second 5,000 gallons and the third if necessary not more than 10,000 gallons. It is important that the well be cleaned out and tested after each stage. Then if the results of any one stage are satisfactory the others can be eliminated.

Even should the results of the third and deepest zone prove satisfactory it may be found desirable to treat the zone 1 interval. In such case the casing should be perforated with from 300 to 400 perforations opposite the interval from 1520 to 1741 feet. Then the recommended acid treatment should be applied. Shooting, of course, would be eliminated in such a case.

Although carbonaterocks, such as limestones, are not all equally soluble in acid, where properly applied, the acid produces amazing results even where the formations have barely a color of oil or a faint gas odor while drilling. Acid enlarges the pores and creates cavities in limestone, especially where major fracturing exists. The deeper the acid penetrates the formations away from the bore hole the greater the outlets, or pores, become permitting a freer flow of oil and gas. Hence the advisability of acidizing in two or three stages, each stage with a greater amount of acid than the preceding one.

It is not possible to estimate the amount of oil or gas that acid treatment will develop on relatively similar formations in widely separated areas. Comparisons may prove unsatisfactory. In order to point out what the proper application of acid can do, however, it may not be amiss to cite the development of a well in the Boundary Buttes area or northeastern Arizona and southeastern Utah which is now producing from Hermosa limestone the geological equivalent of the formation in the lower zone of the Lockhart well.

Byrd-Frost's English No. 1, located in C NE $\frac{1}{4}$ NW $\frac{1}{4}$ Section 22 T 43 S R 22 E., San Juan County, Utah, topped the Hermosa formation of the Pennsylvanian at 3790 feet. The lime core showing gas and oil. Laboratory tests of the core did not show good porosity. A drill stem test, however, from 4625 to 4677, open 1 $\frac{1}{2}$ hours, had gas at the surface in ten minutes estimated at 250,000 cubic feet per day.

The zone was treated with acid through 200 perforations in the casing. The first stage of 1,000 gallons did not produce any additional gas. The second treatment with 2,000 gallons increased the flow of gas to from eight million to ten million cubic feet per day. The last stage of 10,000 gallons developed the flow of gas to an actual measurement of 20 million cubic feet per day. At the time of completion it was also making a small amount of high gravity oil.

Laboratory tests of the cores from the two horizons mentioned above in the Lockhard No. 1 well indicate that the three stage acid treatment recommended has better than an average chance of developing commercial production. Both zones are equally important and both should be tested, zone No. 1 even if the acid has to be applied through casing perforations.

Respectfully submitted,

signed O. A. Larrazolo, Jr.

Report to Messrs. J. M. Kellogg and W. H. Weast,

Phoenix, Arizona

by Ed D. McKee

8-27-49

- I SUBJECT: Stratigraphic geology of L. M. Lockhart, No. 1 Aztec Well,
Sec. 33, T 14 N, R 20 E, Navajo County, Arizona, Elevation 6011 ft.
- II INTRODUCTION TO STRATIGRAPHIC COLUMN AT WELL: The following
condensed description of the geologic strata represented has
been compiled from the log of Stanolind Oil and Gas Company
and from examination of well cores and samples.

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
0	Sandstone, white, quartzitic, fine-grained	<u>Coconino</u>
550	Shale, red brown, silty, calcarcons, in sandstone	<u>Supai</u>
620	Anhydrite and gypsum in shale	
820	Sandstone, alternating with gypsum, anhydrite, halite	
1070	Shale, gray and brown, silty, dolomitic, massive	
1110	Anhydrite, mottled to white, hard, dense	
1140	Halite, grading down into anhydrite and shale	
1250	Shale, gray brown, calcareous	
1270	Shale, red brown, halite inclusions; grading down to anhydrite, halite, sandstone, red shale	
1540	Dolomite, dark gray to black, silty, some black organic matter	Fort Apache /memb.
1570	Shale, gray, alternating with dolomite	Base Ft. Apache
1678	Dolomite, brownish gray	
1750	Shale, red brown, dolomitic	Base Up. Supai //
1770	Halite, with beds of sandstone and anhydrite	
2160	Anhydrite, gray, massive with halite	
2175	Shale, red to chocolate brown, sandy, includes gypsum and minor beds of sandstone	
2620	Shale, gray, highly micaceous, dolomitic	
2755	Dolomite, brown to gray brown, silty	
2780	Shale, gray, dolomitic, and some dolomite	
2860	Limestone, gray brown, shaly, dolomitic, with minor streaks of brown, calcareous shale	
2904	Shale, brown, calcareous, hard, dense; some gypsum	

✓
no permit

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
2930	Shale, brown, calcareous; streaks of brown limestone	
2938	Limestone, cherty, hard, silty, interbedded with calcareous, mottled green shale	
2995	Shale, brown, calcareous, fractured, with anhydrite inclusions	
3015	Limestone conglomerate; smooth brown limestone pebbles in lime matrix	Base of Middle Supai //
3020	Shale, blue gray, calcareous, silty	
3040	Shale, brown, calcareous, small lime pebbles	
3090	Limestone, brown, silty, some fractures	
3107	Shale, brown, calcareous	
3121	Limestone, gray, very shaly	
3127	Shale, brown, calcareous	
3132	Limestone, dark gray, silty	
3138	Shale, brown gray, calcareous	
3141	Limestone, gray, very silty, nodular	
3147	Limestone, aphanitic, gray, cherty, fractured	
3156	Shale, dark brownish gray, calcareous	
3166	Limestone, gray, silty, cherty	
3175	Shale, dark gray to black, fossiliferous, calcareous, with minor fractures	
3184	Limestone, gray, massive, coarse grained, fossiliferous	
3216	Shale, micaceous, silty, calcareous; minor fractures	
3273	Shale, gray, silty, bentonitic, calcareous, with lime pebbles	
3296	Limestone, gray, alternating with gray shale	
3385	Shale, mottled, red brown, calcareous, nodular, and limestone, thin, granular shaly	
3424	Limestone, gray, granular, silty, fossiliferous; some chert, minor fractures	
3471	Sandstone, very fine grained, fractured, calcareous	
3479	Limestone, gray, cherty, granular, minor fractures; grades down into shaly limestone	
3505	Shale, red brown, calcareous, micaceous, with beds of fossil limestone	
3539	Sandstone, dark gray, hard, fine-grained, with purple shale partings	
3544	Limestone, light gray, coarse-grained, silty, with shaly partings and gray brown nodular shale	
3575	Shale, red brown, calcareous, fossiliferous	
3610	Shale, red, silty, mottled, with subangular granite fragments	
3641	Sandstone, very shaly, fine to medium-grained, calcareous; some limestone inclusions	

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
3650	Limestone, dolomitic, silty, massive, with minor fractures	
3657	Limestone, dolomitic, granular, sandy, with vugs of white crystalline limestone, major fractures	
3685	Limestone, dolomitic, gray green, with thin gnarly beds of sandy shale	
3708	Sandstone, fine-grained, calcareous	
3724	Granite, biotite, weathered	<u>Pre-Cambrian</u>

III AGE OF STRATA AND RELATION TO SEDIMENTARY BASIN: Most, if not all, of the sedimentary strata encountered in the well are of Pennsylvanian and Permian age. Pre-Cambrian granite was encountered at the bottom and a small thickness of Devonian and Mississippian strata may possibly rest upon it, though the writer believes that Pennsylvanian beds extend down to the granite. It is important to note that this well is located on the margin of a basin of Pennsylvanian age and near the center of the deepest basin of Permian age (3200 feet) in Arizona.

IV ZONES THAT SHOW OIL CONCENTRATIONS: According to core analysis by Stanolind Oil and Gas Company the following zones were found to contain oil (Analyses made by research department in Tulsa) as per attached enclosure.

1678 - 1741
2873 - 3129
3175 - 3449
3452 - 3515
3657 - 3708

V ZONES OF POROSITY AND HIGH RESISTIVITY FROM ELECTRIC LOG:

An electric log prepared by Schlumberger Well Surveying Corporation (see attached) indicates the following:

- (1) Porous zone in limestone with high resistivity from 1510 to 1730 feet.
- (2) Various zones of porosity and high resistivity in limestone indicated between 2873 and 3565 feet.
- (3) Zone in limestone between 3657 and 3708 indicates a porous zone of high resistivity related to area of major fracturing observed in the cores.

VI ZONES OF OBSERVED FRACTURE: According to D. M. Ferebee, who was geologic observer for Stanolind Oil and Gas Company, the following zones of fracture in limestone were noted.

- (1) Minor fracturing in limestone 1678 - 1741 feet.
- (2) Minor fracturing in limestone and shale 2873 - 3515 feet.
- (3) Major fracturing in limestone 3657 - 3704 feet.

VII GENERAL CONCLUSIONS: Most favorable zone for testing, based on field examination of cores and cuttings, on Schlumberger log of well and on lab analysis of core appears to be between 3600 - 3708 feet. A second favorable well for testing is indicated between 1510 and 1730 feet. Should a successful completion be made in either or both of these zones, further testing would seem to be warranted in the porous sections of the zone between 2873 - 3565 feet.

Mr. Perm

VIII INCLOSURES:

- (1) Slumberger detail log of Lockhart No. 1 Aztec Well.
- (2) Slumberger general log " " " " "
- (3) Core analysis summaries " " " " " by
Stanolind Oil and Gas Company.

Report submitted August 27, 1949

Edwin D. McKee

Edwin D. McKee,
Geologist

Postoffice Box 554
Flagstaff, Arizona

The permit

ARIZONA STATE LAND DEPARTMENT
Sundry Notices and Reports on WellsLease or
Permit No. _____

Notice of intention to drill _____
Notice of intention to change plans _____
Notice of date for test of water shut-off _____
Report on result of test of water shut-off _____
Notice of intention to re-drill or repair well _____
Notice of intention to shoot _____
Subsequent record of shooting _____
Record of perforating casing _____
Notice of intention to pull or otherwise alter casing _____
Notice of intention to abandon well _____
Subsequent report of abandonment _____
Supplementary well history _____

XX

(Indicate above by check mark nature of report, notice or other data)

June 6, 19 49

Following is a (Notice of intention to do work) on land under (permit) described as follows:
(Report of work done) (lease)

Well No. L.M. Lockhart "Aztec Land & Cattle Company, Ltd." No. 1Section
Section 33Township
T. 14 N.Range
R. 20 E. G&SM

The well is located 179.6 feet (S) of XXX E-W center line and 1305.6 feet
(W) of XXX East line of

Section 33, T. 14 N., R. 20 E., G&SM, Navajo County, Snowflake Area, ArizonaThe elevation of the derrick floor above sea level is 6009 feet

DETAILS OF PLAN OF WORK

(State names of an expected depth to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other proposed work.)

Well was drilled and cored to a total depth of 3734 which depth was reached on June 3, 1949.

Top of a pinkish biotite granite was reached at 3724'. No commercial oil or gas formations were encountered. After consultation with Mr. L. A. Heindl of the Arizona State Land Dept.

on June 6, 1949, the following abandonment procedure was agreed upon: To push down a 5 foot wooden plug with drill-pipe and drill-collars to 700 feet. To pack it off on top with (balance on back of this page)

Approved June 21, 1949Company L. M. LOCKHARTBy L. M. Lockhart
Operator

Phoenix, Arizona

Arizona State Land Department

Address 824 Wilshire Blvd.
Los Angeles 14, California

Address _____

NOTE:—Reports on this form to be submitted in triplicate to the Commissioner for approval.

No permit

Continued from Front Page

sawdust in sacks. To then place 26 sacks of cement on top of sawdust which will fill hole to 650 feet. To cut off the 20" conductor pipe one foot above bottom of cellar. To weld a 3/8" steel plate over top of 20" conductor pipe. To weld a 2" pipe to above plate which will extend above ground level as a marker for well when cellar filled. To fill cellar to ground level and level off location. The well to be abandoned in accordance with the above described program.

STANOLIND OIL & GAS CO.
Research Dept.

9-3

L. M. Lockhart
Aztec #1
Wildcat Navajo County, Arizona
Location Sec. 33. T14NR 20 E N4
Formation Analyzed Ft. Apache Zone upper Supai

Lab. No. 2708
Date Reported 4-18-49
Date Received 4-12-49

Coring Data
Zone 1678-1741
Start Coring 1678
Top of Sand 1540
Bottom of Sand 1750
Stopped Coring 1741
Total Feet Cored 63
Total Feet Formation 210
Recovery, Feet of Formation 63
Recover % of Formation 30.0

Type of Drilling Fluid (Oil or water Base muc) Gel Base with Sawdust
Filtrate Loss (CC. Per Min. Api) ---

Summary of Core Analysis

Oil Content (By Zone)	Extraction Feet of Sand	Density		Wtd. Avg.	Av. Sp. Gr.
		Max.	Min.		
1678-1741	63	10.2	.7	3.5	3:

* For comparative purposes only. Not to be used in estimating oil in place.

Permeability*

Zone	Feet of Sand	Max.	Millidarcys		Capacity Ft. XMD
			Min.	Wtd. Avg.	
1678-1741	63	22.00	<.05	.65	40.95

*Unless Noted Otherwise Permeabilities are Parallel To Bedding Planes

< Indicates "Less than" > Indicates "Greater Than"

Letter of transmittal by D.M. Firebee, no date no file

With graphical core analysis to g.

Acid response test to follow as supplement to this report.

cc: Lewis Finch, Jr., H. T. Morley (2), C. F. Bedford,
D. M. Firebee

L. M. Lockhart

Aztec # 1

Wildcat Navajo County Arizona

Location Sec. 33 T14NR20E

Formation Analyzed Lower Supai Marine Penn (Naco?)

Mississippian (Redwall) Elev. 5990'

Lab. No. 2708

Date Reported 5-24-49

Date Received 5-20-49

Coring Data

Zone	2873-3129	3175-3449	3452-3513
Start Coring	2873	3175	3452
Top of Sand	2480	3175	3452
Bottom of Sand	3175?	3452	***
Stopped Coring	3129	3452	3513
Total Feet Cored	54*	100**	61
Total Feet of Formation	695	277	-----
Recovery Ft. of Formation	51	86	61
Recovery % of Formation	7.2	31.0	-----

Type of Drilling Fluid (oil or water base mud) Gel and Sawdust
Filtrate Loss (CC per 30 min AFD) High

* Does not include drilling interval of 202'

** Does not include drilling interval of 177'

Summary of Core Analysis

Oil Content (By Extraction)

Zone	Feet of Net Sand	Mx.	Porosity Min.	Wtd. Avg.	Avg. Oil Sat. %
2873-3129	51	5.0	< .5	1.6	2.0
3175-3449	76	1.8	< .5	.8	11.9
3452-3513	61	3.7	< .5	1.2	5.3

* For comparative Purposes only, Not to be used in estimating oil in place

Permeability*

Zone	Feet of Net Sand	Mx.	Min.	Wtd Avg.	Cap. Ft. XMD
2873-3129	51	4.45	< .05	.41	20.91
3175-3449	76	< .05	< .05	< .05	3.80
3452-3513	61	< .05	< .05	< .05	2.75

Unless noted otherwise Permeabilities are parallel to Bedding Planes
< Indicates "Less Than" > Indicates "Greater Than"

Letters of transmittal by D.M.Ferebee, 5-12-49 no file.

With graphical core analysis log.

Please attach to Report #2708 dated 4-18-49

Acid Solubility test to follow as a supplement

CCLewis Finch, Jr., H.T.Mo rley (2), C.F.Redford, D.M.Ferebee

By J. W. Spurlo ck

9-3

L.M. Lockhart
 Aztec Unit #1
 Field Wildcat Navajo Co. Arizona
 Location Sec. 33 T14N R20E
 Formation Analyzed Mississippian? Devonian? El. 5990'

Lab. No. 2708
 Date Reported 6-3-49
 Date Received 6-3-49

Coring Data

Zone	3657-3685	3685-3708
Start Coring	3657	3685
Top of sand	3452	3685
Stopped Coring	3685	-----
	3685	3708

Total Feet Cored	21 *	23
Total Feet Formation	33	***
Recovery Feet of Formation	16	21
Recovery % of Formation	48.5	----

Type of Drilling Fluid Gel and Sawdust
 Filtrate Loss 9CC per 30 min. API) High

*Does not include drilling interval of 7'

Summary of Core Analysis

Oil content (By Extraction)	Ft. of	Porosity			Average Oil Data
Zone	Net Sand	Max.	Min.	Wtd. Avg.	

3657-85	16	5.7	1.1	2.9	23.9
3685-3708	21	1.6	< .5	.9	9.6

* For comparative purposes only, Not to be used in estimating oil in place.

Permeability* Millidarcys

Zone	Ft. of Net Sand	Max.	Min.	Wtd. Av.	Capacity Ft. XMD
3657-85	16	.85	< .05	.10	1.60
3685-3708	21	< .05	< .05	< .05	1.05

Letter transmittal by D.M. Ferebee, dated 6-1-49 no file.
 With graphical core analysis log.
 Other test to follow as supplements.

ANOLIND OIL AND GAS COMPANY **RESEARCH DEPARTMENT** **CORE ANALYSIS SUMMARY**

WELL L. M. Lockhart LAB. NO. 2708
 FIELD Wildcat, Navajo County, Arizona DATE REPORTED 4-18-49
 LOCATION Sec. 33 T14N R 20E DATE RECEIVED 4-12-49
 FORMATION ANALYZED Ft. Apache Zone upper Supai ELEV. _____

CORING DATA

ZONE 1678-1741
 START CORING 1678
 TOP OF SAND 1540
 BOTTOM OF SAND 1750
 STOPPED CORING 1742
 TOTAL FEET CORED 63
 TOTAL FEET OF FORMATION 210
 RECOVERY, FEET OF FORMATION 63
 RECOVERY, % OF FORMATION 30.0

TYPE OF DRILLING FLUID (OIL OR WATER BASE MUD) Jel Base with Sawdust
 FILTRATE LOSS (CC. PER 30 MIN. API) _____

SUMMARY OF CORE ANALYSIS

OIL CONTENT (BY EXTRACTION)

ZONE	FEET OF NET SAND	POROSITY			AVERAGE OIL SAT. %
		MAX.	MIN.	WTD. AVG.	
1678-1741	63	10.2	.7	3.5	32.6

*FOR COMPARATIVE PURPOSES ONLY. NOT TO BE USED IN ESTIMATING OIL IN PLACE.

PERMEABILITY

ZONE	FEET OF NET SAND	MILLIDARCY			CAPACITY FEET X W. D.
		MAX.	MIN.	WTD. AVG.	
1678-1741	63	27.00	<.05	.65	40.95

*UNLESS NOTED OTHERWISE, PERMEABILITIES ARE PARALLEL TO BEDDING PLANES
 "<" INDICATES "LESS THAN"; ">" INDICATES "GREATER THAN"

Letter of transmittal by D. M. Firebee, no date, no file
 with graphical core analysis log.
 Acid response test to follow as supplement to this report.

cc: Lewis Finch, Jr.
 H. T. Morley (2)
 C. F. Bedford
 D. M. Firebee

FORM 603 1-48

9-3

L. H. Lockhart
Astec #1

ANOLIND OIL AND GAS COMPANY
RESEARCH DEPARTMENT
CORE ANALYSIS DATA RECORD

FIELD Wildcat

STATE Arizona

DATE 5-5-49

LAB. NO. 2708

SAMPLE NO.	DEPTH	DESCRIPTION	PERMEABILITY-MILLIDARCS		EFFECTIVE POROSITY %	SATURATION % CORE STAGE			% SOLIDS IN 10% SOL.	GRAVITY OF OIL °API @ 60° F	MINIMUM WATER SATURATION %
			VERTICAL	HORIZONTAL		OIL	WATER	TOTAL			
A	1678-90								71.5		
E	1710-11								76.2		
H	1726-28								69.5		

The reported permeability values are based on data from sections of core that have been subjected to air or water saturation. Permeability values are not valid for other fluids or saturations.

14-35/4 Sec 33-1W 14N-R 20E

STANDARD OIL AND GAS COMPANY
RESEARCH DEPARTMENT
CORE ANALYSIS DATA RECORD

9-3
L. M. Lockhart
WELL Astec #1

FIELD Willamette

STATE Astoria

DATE 4-12-48

LAB. NO. 2702

SAMPLE NO.	DEPTH	DESCRIPTION	PERMEABILITY - MILLIDARREYS		EFFECTIVE POROSITY %	SATURATION % (WATER)			G. SAMPLE IN ONE CIL	QUANTITY OF GAS "AN @ 25° P"	REMARKS
			VERTICAL	HORIZONTAL		GR.	WATER	TOTAL			
A	1678-90	Shaly Dolomite	<.05	.42	4.9	24.0	72.6	100.0			
B	1690-94	"		.38	2.4	32.5	67.5	100.0			
C	1694-1703	"		.35	10.0	42.8	37.2	100.0			
D	1703-10	"		.30	.7	27.3	72.7	100.0			
E	1710-11	"	.25	27.80	20.8	38.2	72.8	91.1			
F.	1711-12	"		<.05	2.3	22.8	77.2	100.0			
G	1712-24	"		<.05	.7	27.3	72.7	100.0			
H	1724-28	"		<.05	4.5	19.6	80.4	100.0			
I	1728-30	"	<.05	<.05	2.1	28.2	71.8	100.0			
						25	43.13	100			

The following saturation, porosity and permeability data are obtained from portion of core horizontally adjacent to or within two inches vertically of portion on which permeability, porosity and saturation tests are made.
*From Capillary Pressure Determination Test.

BY J. W. Spurlock

1/4-SE/4 Sec 33-TWP 14-N-R 20E1

Interval Feet	Core Number	Permeability mD	Porosity %	Acidizing Test	Interval Feet	Core Number	Permeability mD	Porosity %	Acidizing Test
1	1678-80		<.05	14.2	1	1678-80		71.9	100.0
2	1678-81			11.8	2	1678-81		71.9	100.0
3	1678-82			.35	3	1678-82		71.9	100.0
4	1678-83			.80	4	1678-83		71.9	100.0
5	1678-84			.25	5	1678-84		71.9	100.0
6	1678-85			27.98	6	1678-85		71.9	100.0
7	1678-86			<.05	7	1678-86		71.9	100.0
8	1678-87			<.05	8	1678-87		71.9	100.0
9	1678-88			<.05	9	1678-88		71.9	100.0
10	1678-89			<.05	10	1678-89		71.9	100.0
11	1678-90			<.05	11	1678-90		71.9	100.0
12	1678-91			<.05	12	1678-91		71.9	100.0
13	1678-92			<.05	13	1678-92		71.9	100.0
14	1678-93			<.05	14	1678-93		71.9	100.0
15	1678-94			<.05	15	1678-94		71.9	100.0
16	1678-95			<.05	16	1678-95		71.9	100.0
17	1678-96			<.05	17	1678-96		71.9	100.0
18	1678-97			<.05	18	1678-97		71.9	100.0
19	1678-98			<.05	19	1678-98		71.9	100.0
20	1678-99			<.05	20	1678-99		71.9	100.0
21	1679-00			<.05	21	1679-00		71.9	100.0
22	1679-01			<.05	22	1679-01		71.9	100.0
23	1679-02			<.05	23	1679-02		71.9	100.0
24	1679-03			<.05	24	1679-03		71.9	100.0
25	1679-04			<.05	25	1679-04		71.9	100.0
26	1679-05			<.05	26	1679-05		71.9	100.0
27	1679-06			<.05	27	1679-06		71.9	100.0
28	1679-07			<.05	28	1679-07		71.9	100.0
29	1679-08			<.05	29	1679-08		71.9	100.0
30	1679-09			<.05	30	1679-09		71.9	100.0
31	1679-10			<.05	31	1679-10		71.9	100.0
32	1679-11			<.05	32	1679-11		71.9	100.0
33	1679-12			<.05	33	1679-12		71.9	100.0
34	1679-13			<.05	34	1679-13		71.9	100.0
35	1679-14			<.05	35	1679-14		71.9	100.0
36	1679-15			<.05	36	1679-15		71.9	100.0
37	1679-16			<.05	37	1679-16		71.9	100.0
38	1679-17			<.05	38	1679-17		71.9	100.0
39	1679-18			<.05	39	1679-18		71.9	100.0
40	1679-19			<.05	40	1679-19		71.9	100.0
41	1679-20			<.05	41	1679-20		71.9	100.0
42	1679-21			<.05	42	1679-21		71.9	100.0
43	1679-22			<.05	43	1679-22		71.9	100.0
44	1679-23			<.05	44	1679-23		71.9	100.0
45	1679-24			<.05	45	1679-24		71.9	100.0
46	1679-25			<.05	46	1679-25		71.9	100.0
47	1679-26			<.05	47	1679-26		71.9	100.0
48	1679-27			<.05	48	1679-27		71.9	100.0
49	1679-28			<.05	49	1679-28		71.9	100.0
50	1679-29			<.05	50	1679-29		71.9	100.0
51	1679-30			<.05	51	1679-30		71.9	100.0
52	1679-31			<.05	52	1679-31		71.9	100.0
53	1679-32			<.05	53	1679-32		71.9	100.0
54	1679-33			<.05	54	1679-33		71.9	100.0
55	1679-34			<.05	55	1679-34		71.9	100.0
56	1679-35			<.05	56	1679-35		71.9	100.0
57	1679-36			<.05	57	1679-36		71.9	100.0
58	1679-37			<.05	58	1679-37		71.9	100.0
59	1679-38			<.05	59	1679-38		71.9	100.0
60	1679-39			<.05	60	1679-39		71.9	100.0
61	1679-40			<.05	61	1679-40		71.9	100.0
62	1679-41			<.05	62	1679-41		71.9	100.0
63	1679-42			<.05	63	1679-42		71.9	100.0
64	1679-43			<.05	64	1679-43		71.9	100.0
65	1679-44			<.05	65	1679-44		71.9	100.0
66	1679-45			<.05	66	1679-45		71.9	100.0
67	1679-46			<.05	67	1679-46		71.9	100.0
68	1679-47			<.05	68	1679-47		71.9	100.0
69	1679-48			<.05	69	1679-48		71.9	100.0
70	1679-49			<.05	70	1679-49		71.9	100.0
71	1679-50			<.05	71	1679-50		71.9	100.0
72	1679-51			<.05	72	1679-51		71.9	100.0
73	1679-52			<.05	73	1679-52		71.9	100.0
74	1679-53			<.05	74	1679-53		71.9	100.0
75	1679-54			<.05	75	1679-54		71.9	100.0
76	1679-55			<.05	76	1679-55		71.9	100.0
77	1679-56			<.05	77	1679-56		71.9	100.0
78	1679-57			<.05	78	1679-57		71.9	100.0
79	1679-58			<.05	79	1679-58		71.9	100.0
80	1679-59			<.05	80	1679-59		71.9	100.0
81	1679-60			<.05	81	1679-60		71.9	100.0
82	1679-61			<.05	82	1679-61		71.9	100.0
83	1679-62			<.05	83	1679-62		71.9	100.0
84	1679-63			<.05	84	1679-63		71.9	100.0
85	1679-64			<.05	85	1679-64		71.9	100.0
86	1679-65			<.05	86	1679-65		71.9	100.0
87	1679-66			<.05	87	1679-66		71.9	100.0
88	1679-67			<.05	88	1679-67		71.9	100.0
89	1679-68			<.05	89	1679-68		71.9	100.0
90	1679-69			<.05	90	1679-69		71.9	100.0
91	1679-70			<.05	91	1679-70		71.9	100.0
92	1679-71			<.05	92	1679-71		71.9	100.0
93	1679-72			<.05	93	1679-72		71.9	100.0
94	1679-73			<.05	94	1679-73		71.9	100.0
95	1679-74			<.05	95	1679-74		71.9	100.0
96	1679-75			<.05	96	1679-75		71.9	100.0
97	1679-76			<.05	97	1679-76		71.9	100.0
98	1679-77			<.05	98	1679-77		71.9	100.0
99	1679-78			<.05	99	1679-78		71.9	100.0
100	1679-79			<.05	100	1679-79		71.9	100.0

The reported permeability, porosity and acidizing test data are obtained from portion of core horizontally adjacent to or within two inches vertically of portion on which permeability, porosity and acidizing tests are made.

By J. W. Spurlock

I CERTIFY THAT THIS IS A TRUE AND EXACT PHOTO
NEGATIVE OF THE ORIGINAL AND WAS MADE BY ME
THIS 27 DAY OF April
19 49.

Jack Barron
Photostat Operator
R. M. METCALFE, INC.
ALBUQUERQUE, NEW MEXICO

No permit

E/A-SE/A Sec 33-TWP 14N-R 20E

FORM G-48

NOLIND OIL AND GAS COMPANY
RESEARCH DEPARTMENT
CORE ANALYSIS SUMMARY

L. M. Lockhart
WELL Astec #1 LAB. NO. 2708
FIELD Wildecat, Navajo County, Arizona DATE REPORTED 5-24-49
LOCATION Sec. 33 T14N R20W DATE RECEIVED 5-20-49
FORMATION ANALYZED Lower Supai Marine Penn (Naco?) ELEV. 5990'
Mississippian (Redwall?)

CORING DATA

ZONE	2873-3129	3175-3449	3452-3513
START CORING	2873	3175	3452
TOP OF SAND	2480	3175	3452
BOTTOM OF SAND	3175 ?	3452	—
STOPPED CORING	3129	3452	3513
TOTAL FEET CORED	54 *	100 **	61
TOTAL FEET OF FORMATION	695	277	—
RECOVERY, FEET OF FORMATION	51	86	61
RECOVERY, % OF FORMATION	7.4	31.0	—

TYPE OF DRILLING FLUID (OIL OR WATER BASE MUD) Jel and sawdust
FILTRATE LOSS (CC. PER 30 MIN. APPROX) High

* Does not include drilling interval of 202'

** Does not include drilling interval of 177'

SUMMARY OF CORE ANALYSIS

OIL CONTENT (BY EXTRACTION)

ZONE	FEET OF NET SAND	POROSITY			AVERAGE OIL SAT. %
		MAX.	MIN.	WTD. AVG.	
2873-3129	51	5.0	<.5	1.6	2.0
3175-3449	76	1.8	<.5	.8	11.9
3452-3513	61	3.7	<.5	1.2	5.3

*FOR COMPARATIVE PURPOSES ONLY. NOT TO BE USED IN ESTIMATING OIL IN PLACE.

PERMEABILITY*

ZONE	FEET OF NET SAND	MILLIDARCYS			CAPACITY FEET X M. D.
		MAX.	MIN.	WTD. AVG.	
2873-3129	51	4.45	.05	.41	20.91
3175-3449	76	<.05	.05	<.05	3.80
3452-3513	61	<.05	.05	<.05	2.75

*UNLESS NOTED OTHERWISE, PERMEABILITIES ARE PARALLEL TO BEDDING PLANES
" < " INDICATES "LESS THAN"; " > " INDICATES "GREATER THAN";

Letters of transmittal by D. H. Ferebee, 5-12-49, no file.
with graphical core analysis log.
Please attach to report 2708, dated 4-18-49,
acid solubility test to follow as a supplement

cc: Lewis Finc, Jr.
H. I. Morle. (2)
C. F. Bedford
D. H. Ferebee

BY J. H. Spurllock

No permit

SONOLIND OIL AND GAS CO.
RESEARCH DEPARTMENT
CORE ANALYSIS DATA RECORD

9-3
L. M. Lockhart
Artes #1

FIELD Wildcat

STATE Arizona

DATE 5-21-49

LAB. NO. 2706

SAMPLE NO.	DEPTH	DESCRIPTION	PERMEABILITY-MILLIDARCS		EFFECTIVE POROSITY %	SATURATION % PORE SPACE			% SOLUBLE IN 10% NCL	GRAVITY OF OIL @ 60° F	MINIMUM WATER SATURATION %
			VERTICAL	HORIZONTAL		OIL	WATER	TOTAL			
J	2873-76	Sandy Shale	<.05	.43	.7	1.7	98.3	100.0			
K	2876-82	"		<.05	<.5						
L	2900-05	"		<.05	<.5						
M	3037-39	"		4.45	5.0	0.0	100.0	100.0			
N	3039-46	"		<.05	.7	0.0	100.0	100.0			
O	3046-49	"	<.05	<.05	1.4	21.3	78.7	100.0			
P	3049-52	"		<.05	.5						
Q	3052-61	"		<.05	1.0	0.0	100.0	100.0			
R	3061-69	"		<.05	3.4	0.0	100.0	100.0			
S	3124-29	"		1.74	3.4	1.3	98.7	100.0			
T	3175-80	Sandy Shale	<.05	<.05	1.1	11.8	88.2	100.0			
U	3180-84	"		<.05	1.8	20.8	50.0	70.8			
V	3184-87	"		<.05	.5						
W	3201-05	"		<.05	.5						
X	3216-22	"		<.05	.5						
Y	3284-87	"		<.05	.5						
Z	3287-92	"		<.05	.5						
AA	3351-56	"		<.05	.5						
AB	3356-65	"	<.05	<.05	.5						
AC	3365-74	"	<.05	<.05	.6	7.4	92.6	100.0			
AD	3374-79	"		<.05	1.0	54.6	45.4	100.0			
AE	3422-27	"		.05	.5						
AF	3427-36	"		.05	1.3	0.0	100.0	100.0			
AG	3444-49	"		<.05	.9	0.0	100.0	100.0			
AH	3452-58	Sandy Shale	<.05	<.05	1.1	3.0	97.0	100.0			
AI	3458-67	"		<.05	1.0	12.3	87.2	100.0			
AJ	3467-75	"		<.05	1.2	0.0	100.0	100.0			
AK	3475-84	"		<.05	.5						
AL	3484-91	"		<.05	.5						
AM	3491-3500	"		<.05	.9	1.7	98.3	100.0			
AN	3500-08	"		.05	3.7	9.6	67.4	77.0			
AO	3508-13	"		<.05	.7	0.0	100.0	100.0			

The reported saturation, solubility and core analysis data are obtained from portion of core horizontally adjacent to or within two inches vertically of portion on which permeability, porosity and acidizing tests are made.
*From Capillary Pressure Saturation Test.

BY J. J. Sparlock

1/4-SH/A Sec 33-1-WP 14N-R 20E-1

STANOLIND OIL AND GAS COMPANY RESEARCH DEPARTMENT CORE ANALYSIS SUMMARY

L. M. Lockhart
WELL Axtac Unit #1 LAB. NO. 2708
FIELD Hildcat, Navajo County, Arizona DATE REPORTED 6-3-49
LOCATION Sec. 33 T14N R20E DATE RECEIVED 6-3-49
FORMATION ANALYZED Mississippian? Devonian? ELEV. 5990'

CORING DATA

ZONE	3657-3685	3685-3708
START CORING	3657	3685
TOP OF SAND	3652	3685
BOTTOM OF SAND	3685	---
STOPPED CORING	3685	3708
TOTAL FEET CORED	21 *	23
TOTAL FEET OF FORMATION	33	---
RECOVERY, FEET OF FORMATION	16	21
RECOVERY, % OF FORMATION	48.5	---

TYPE OF DRILLING FLUID (OIL OR WATER BASE MUD) Jel & Sandust
FILTRATE LOSS (CC. PER 30 MIN. API) High

* Does not include drilling interval of 7'

SUMMARY OF CORE ANALYSIS

OIL CONTENT (BY EXTRACTION)

ZONE	FEET OF NET SAND	POROSITY			AVERAGE OIL SAT. %
		MAX.	MIN.	WTD. AVG.	
3657-85	16	5.7	1.1	2.6	23.9
3685-3708	21	1.6	<.5	.9	9.6

*For COMPARATIVE PURPOSES ONLY. NOT TO BE USED IN ESTIMATING OIL IN PLACE.

PERMEABILITY*

ZONE	FEET OF NET SAND	MILLIDARCY			CAPACITY FEET X M. D.
		MAX.	MIN.	WTD. AVG.	
3657-85	16	.85	<.05	.10	1.60
3685-3708	21	<.05	<.05	<.05	1.05

*UNLESS NOTED OTHERWISE, PERMEABILITIES ARE PARALLEL TO BEDDING PLANES
"<" INDICATES "LESS THAN"; ">" INDICATES "GREATER THAN"

Letter of transmittal by D. M. Ferebee, dated 6-1-49, no file
with graphical core analysis log.
Other tests to follow as supplements.

cc: Lewis Finch, Jr.
H. T. Korley (2)
C. F. Dedford
D. M. Ferebee

BY J. V. Spurlock

No permit

STANDARD OIL AND GAS COMPANY
RESEARCH DEPARTMENT
CORE ANALYSIS DATA RECORD

9-3
L. M. Lockhart
Artes Unit #1

FIELD Wildcat

STATE Arizona

DATE 6-3-49

LAB. NO. 2706

SAMPLE NO.	DEPTH	DESCRIPTION	PERMEABILITY-MILLIDARIES		EFFECTIVE POROSITY %	SATURATION % PORE SPACE			% SOLIDS IN 10% MCL	GRAVITY OF OIL @ 60° F	MINIMUM WATER SATURATION %
			VERTICAL	HORIZONTAL		GR.	WATER	TOTAL			
AT	3657-59	Sand	<.05	<.05	1.1	7.6	92.4	100.0			
AU	3659-60	"		.22	1.3	41.4	58.6	100.0			
AV	3660-61	"	<.05	<.05	1.7	26.9	73.1	100.0			
AW	3661-62	"		<.05	1.9	15.7	84.3	100.0			
AX	3669-73	"	<.05	.85	5.7	3.6	6.0	9.6			
AY	3674-79	"	<.05	<.05	1.3	26.9	73.1	100.0			
AZ	3683-85	"	<.05	<.05	2.4	67.2	32.8	100.0			
BA	3685-91	Sand		<.05	1.6	12.6	87.4	100.0			
BB	3691-96	"	.05	<.05	<.5						
BC	3700-04	"		<.05	.9	14.5	85.5	100.0			
BD	3704-08	"	<.05	<.05	.7	0.0	100.0	100.0			

The reported saturation, salinity and above specific data are obtained from portion of core horizontally adjacent to or within two inches vertically of portion on which permeability, porosity and swelling tests are made.
*From Capillary Pressure Saturation Test.

BY J. L. Spurlock

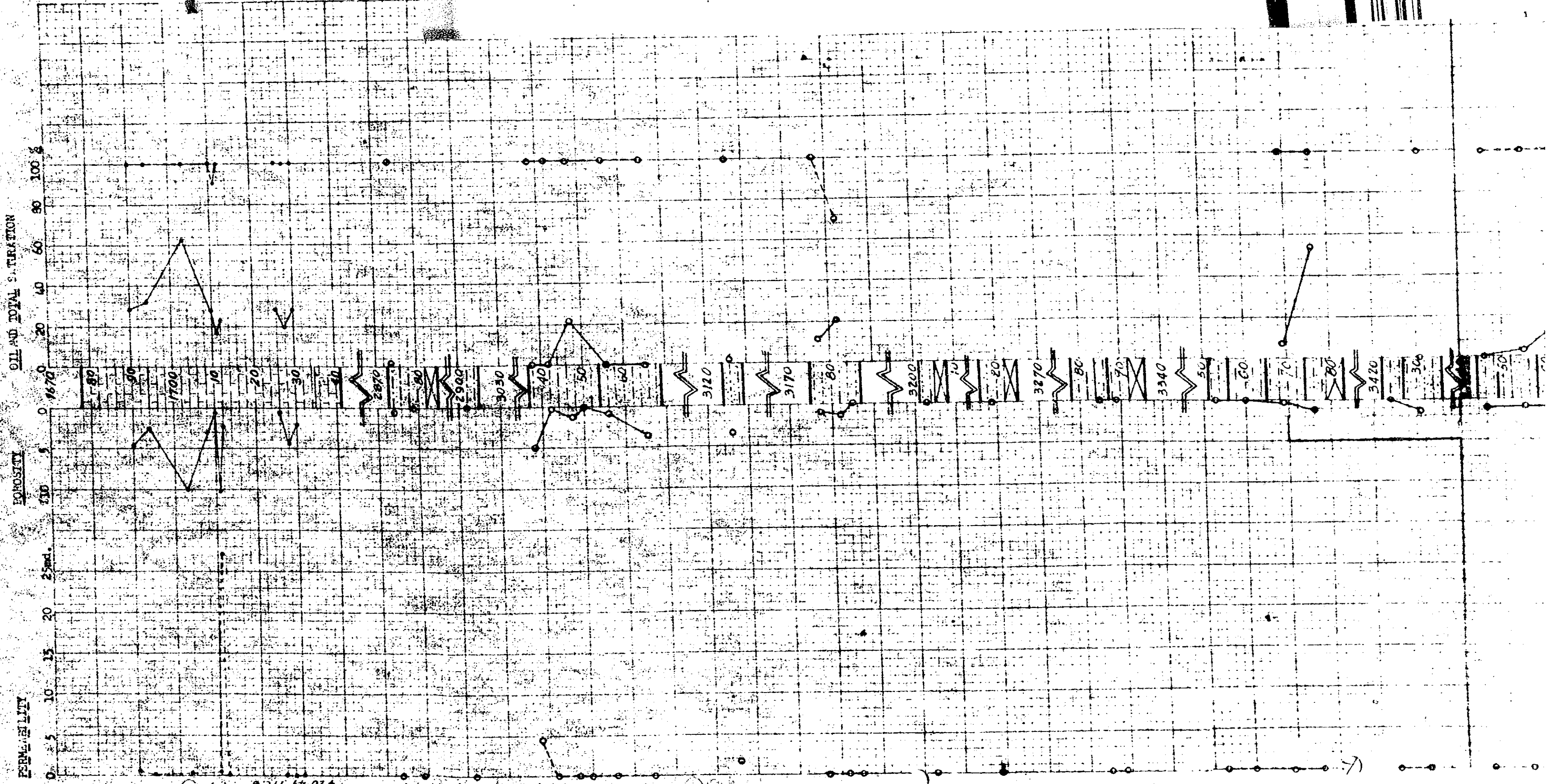
14-351/4 Sec 33-1W-14N-R 20E-1

STANOLIND OIL AND GAS COMPANY
RESEARCH DEPARTMENT
GRAPHICAL WELL LOG

COMPANY: Stanolind Oil and Gas Company
DATE: 4-18-49
WELL: L. N. Leohart
AZ 985 A
Report #2708 FIELD: Wildcat, Navajo County, Arizona

9-3

REMARKS



ARIZONA STATE LAND DEPARTMENT
Sundry Notices and Reports on Wells

Lease or
Permit No.

Notice of intention to drill.....	X
Notice of intention to change plans.....	
Notice of date for test of water shut-off.....	
Report on result of test of water shut-off.....	
Notice of intention to re-drill or repair well.....	
Notice of intention to shoot.....	
Subsequent record of shooting.....	
Record of perforating casing.....	
Notice of intention to pull or otherwise alter casing.....	
Notice of intention to abandon well.....	
Subsequent report of abandonment.....	
Supplementary well history.....	

(Indicate above by check mark nature of report, notice or other data)

February 18, 19 49

Following is a (Notice of intention to do work) on land under (permit) described as follows:
(Report of work done) (lease)

Well No. L.M. Lockhart "Aztec Land & Cattle Company, Ltd." No. 1

Section 33 Township T. 14 N. Range R. 20 E. G&SRM
(2460' fsl) XXXX
The well is located 179.6 feet (S) of E - W center line and 1305.6 feet
(NWNWNESE) (W) of East line of
Section 33 - T. 14 N. - R. 20 E. - G&SRM - Navajo County, Snowflake Area, Arizona
The elevation of the derrick floor above sea level is 5990 feet

DETAILS OF PLAN OF WORK

(State names of an expected depth to objective sands; show sizes, weights, and lengths of proposed casings; indicate mudding jobs, cementing points, and all other proposed work.)

Expect to encounter objective formations from approx. 2000' and will drill with rotary tools to basement or to a depth at which further drilling, in the judgment of the operator, would be unwarranted. Will set and cement approx. 100' of 12 3/4" O.D. R-3, 45# surface casing; and if justified by oil or gas formations encountered, will set and cement a string of 7", 23# new seamless casing. Mud of sufficient weight and substance to prevent blowouts will be used at all times and adequate blow-out prevention equipment will be installed and kept ready for immediate operation.

Approved February 23, 1949

P. C. Williams

Arizona State Land Department

Address

Company L. M. LOCKHART

By *L. M. Lockhart*

301-303 Subway Terminal Bldg.

417 South Hill Street

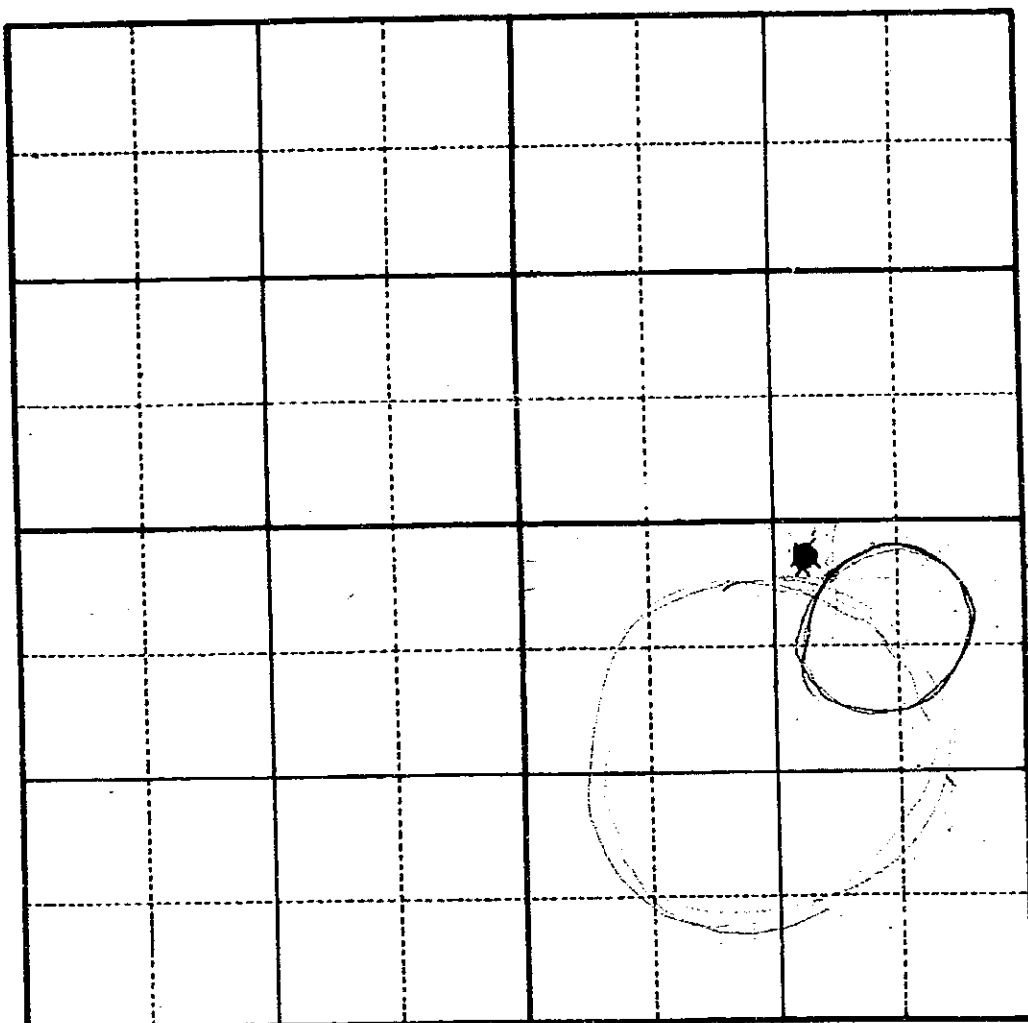
Address Los Angeles 13, California

Phone: Michigan 3697

NOTE:—Reports on this form to be submitted in triplicate to the Commissioner for approval.

No permit

SEC. _____ T. _____ R. _____



SCALE 1" = 1000'

ABSTRACTED _____ AREA _____

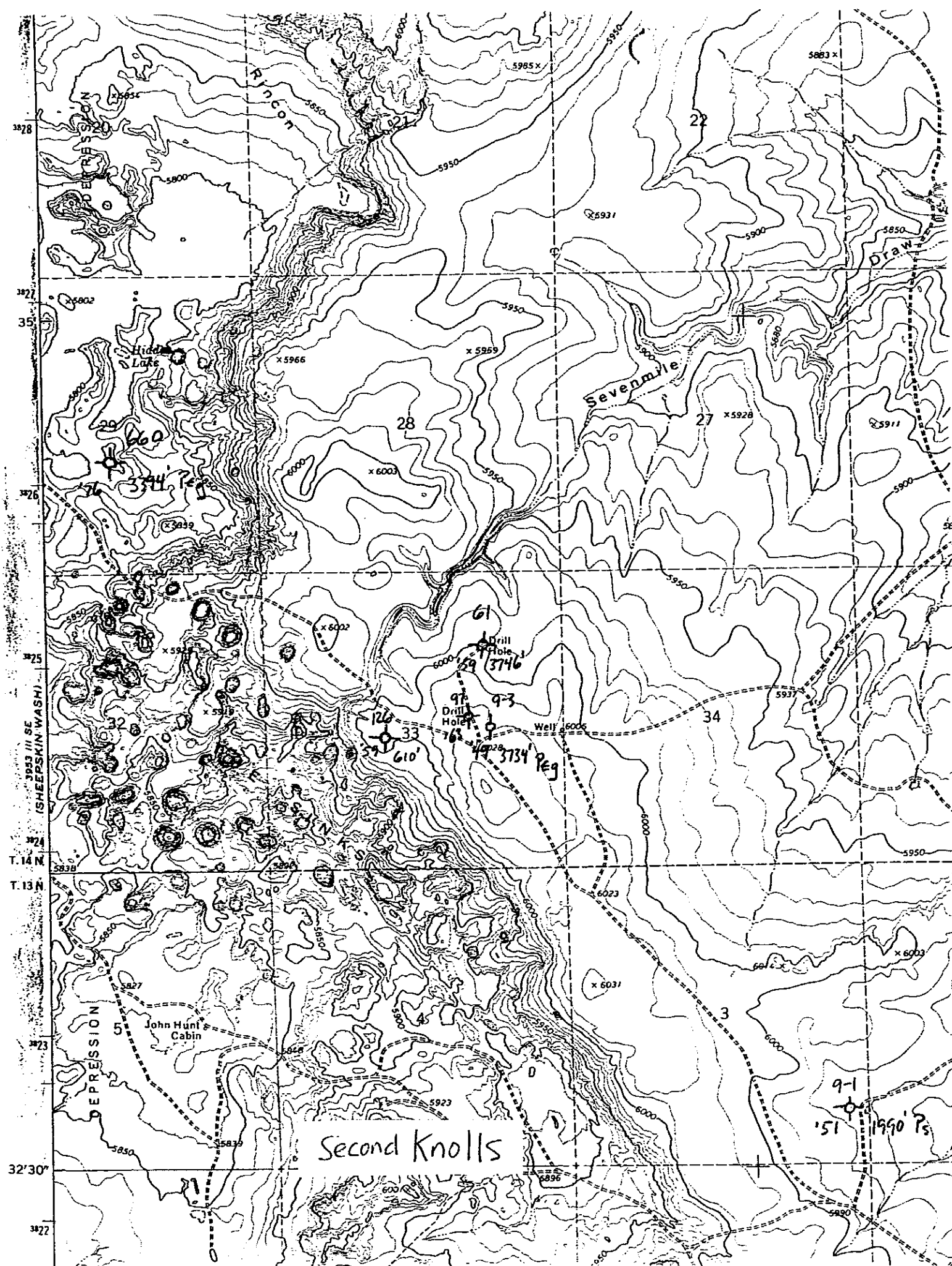
PLAT OF SURVEY FILED _____

K. W. Ouel Co. Agtee #1

NW NW NE SE

NW NW NE SE

no permit



KELLOGG-WEAST-AZTEC #1
(s/a Lockhart-Aztec #1)

Location: Sec. 33, T. 14 N., R. 20 E. Navajo County
Elevation: 6011 ft. (NW 1/4 SE 1/4)
TD: 3724'

Commenced: February 1949
Completed: 1949 (?)

06 # 9-3

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
0	Sandstone, white quartzitic, fine-grained	Coconino
550	Shale, red brown, silty, calcarons, in sandstone	Supai
620	Anhydrite and gypsum in shale	
820	Sandstone, alternating with gypsum, anhydrite, halite	
1070	Shale, gray and brown, silty, dolomitic, massive	
1110	Anhydrite, mottled to white, hard, dense	
1140	Halite, grading down into anhydrite and shale	
1250	Shale, gray brown, calcareous	
1270	Shale, red brown, halite inclusions; grading down to anhydrite, halite, sandstone, red shale	
1540	Dolomite, dark gray to black, silty, some black organic matter	Fort Apache
1570	Shale, gray, alternating with dolomite	/memb.
1678	Dolomite, brownish gray	Base Ft. Apache
1750	Shale, red brown, dolomitic	
1770	Halite, with beds of sandstone and anhydrite	Base Up. Supai
2160	Anhydrite, gray, massive with halite	
2175	Shale, red to chocolate brown, sandy, includes gypsum and minor beds of sandstone	
2620	Shale, gray, highly micaceous, dolomitic	
2755	Dolomite, brown to gray brown, silty	
2780	Shale, gray, dolomitic, and some dolomite	
2860	Limestone, gray brown, shaly, dolomitic, with minor streaks of brown, calcareous shale	
2904	Shale, brown calcareous, hard, dense; some gypsum	
2930	Shale, brown, calcareous; streaks of brown limestone	
2938	Limestone, chert, hard, silty, interbedded with calcareous, mottled green shale	
2995	Shale, brown, calcareous, fractured, with anhydrite inclusions	
3015	Limestone conglomerate; smooth brown limestone pebbles in lime matrix	Base of Middle Supai
3020	Shale, blue gray, calcareous, silty	
3040	Shale, brown, calcareous, small lime pebbles	
3090	Limestone, brown, silty, some fractures	
3107	Shale, brown, calcareous	
3121	Limestone, gray, very shaly	
3127	Shale, brown, calcareous	
3132	Limestone, dark gray, silty	
3138	Shale, brown gray, calcareous	
3141	Limestone, gray, very silty, nodular	
3147	Limestone, aphanitic, gray, cherty, fractured	
3156	Shale, dark brownish gray, calcareous	
3166	Limestone, gray, silty, cherty	
3175	Shale, dark gray to black, fossiliferous, calcareous, with minor fractures	
3184	Limestone, gray, massive, coarse grained, fossiliferous	
3216	Shale, micaceous, silty, calcareous; minor fractures	
3273	Shale, gray, silty, bentonitic, calcareous, with lime pebbles	
3296	Limestone, gray, alternating with gray shale	
3385	Shale, mottled, red brown, calcareous, nodular, and limestone, thin, granular shaly	
3424	Limestone, gray, granular, silty, fossiliferous; some chert, minor fractures	
3471	Sandstone, very fine grained, fractured, calcareous	
3479	Limestone, gray, cherty, granular, minor fractures; grades down into shaly limestone	
3505	Shale, red brown, calcareous, micaceous, with beds of fossil limestone	
3539	Sandstone, dark gray, hard, fine-grained, with purple shale partings	
3544	Limestone, light gray, coarse-grained, silty, with shaly partings and gray brown nodular shale	

KELLOGG-WEAST-AZTEC #1
(s/a Lockhart-Aztec #1) Sec. 33, T. 14 N., R. 20 E. Navajo County

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
3575	Shale, red brown, calcareous, fossiliferous	
3610	Shale, red, silty, mottled, with subangular granite fragments	
3641	Sandstone, very shaly, fine to medium-grained, calcareous; some limestone inclusions	
3650	Limestone, dolomitic, silty, massive, with minor fractures	
3657	Limestone, dolomitic, granular, sandy, with vugs of white crystalline limestone, major fractures	
3685	Limestone, dolomitic, gray green, with thin gnarly beds of sandy shale	
3708	Sandstone, fine-grained, calcareous	
3724	Granite, biotite, weathered	Pre-Cambrian

Report submitted August 27, 1949.

9-112.

COUNTY Navajo	STATE Arizona	TOOLS Rotary	INFO. O/H
WELL L.M. Lockhart-Aztec Land and Cattle Co. #1 (see K-W Ad Co. card)			
LOC. 180' S of EW center line & 1306' W of E line. SE 33 14N-20E (NWNESE) (2468) (260NSL; 1306 WEL)			ELEV. 6000' ground 6011' Kelly bush
CONTRACTOR Dunlap and Graham, Long Beach. Harry Failing, tool pusher			
COMM. March 7, 1949	COMP. June 5, 1949	T. D. 3734'	I. P. P & A
FORMATION RECORD (see reverse side)			CASING 0-4' 20" conductor 4' is below cellar floor.
ACID		SHOT	
REMARKS Drill stem test 1678'-1742' in Ft. Apache series of Supai formation. Air blow for 18 minutes, some smell of distillate. Good shut-off. Adjoining water well TD 583', water sand from 555'-565', water raises to 545', makes about 10 gpm. No sample for analysis taken but water is potable.			
(SCOUT REPORTS ON REVERSE SIDE) no permit			

13 Mar 49 Spudded Mar 7. Drlg @ 325. Kaibab on surface to 138', sandy silty phase. Lost circulation @ 138' and again twice above 300'.

5 Apr 49 Drlg @ 1880 in brown maroon shales (supai) Base of Coconino at 480'. See remarks on front re: drill stem test.

28 Apr 49 Drlg @ 3028. Tough purple-black gritty shale, lime cement. No shows since drill stem test.

20 May 49 Drlg w/ almost continuous wire-line cores at 3600'. Maroon limey shales with few questional oil stains. Core showed a few gas bubbles. Ferebee (Stanlind geologist sitting on well) reports Penna? marine phase 3150'-3450'. His residue examinations show much higher % sol. materials than previously reported. Much over 50% sol.

26 May 49 Coring @ 3659'. 3608-33, very hard chert & cgl. 3622-23 completely dulled one hard-faced bit. 3633-41-50, maroon sandy shales with lime streaks. Considerable slickensides. 3650-57 Coarse recrystallized? limestone w/ shaley streaks.

6 Jun 49 Completed June 5, 1949. Granite @ 3724'. TD 3734'. Schlumberger gamma ray run June 5.

8 Jun 49 Cuttings and cores to MNA.

Hole 20' off vertical at 3400'.

4 feet of 20" conductor casing set at bottom of cellar; bottom of the 4' is 21' below kelly bushing, elevation 6011'.

to 60' 16" hole

60 - 1918' 11" hole

1918 - 3731' 9 5/8" hole

3731 - 3734' 7 5/8" hole (core hole).

Well plugged from 750'-650' in hard shale

COUNTY
Navajo

STATE
Arizona

TOOLS
Rotary

INFO. O/H

9-112

WELL

L.M. Lockhart-Aztec Land and Cattle Co. #1 (see K-W Oil Co. card)

LOC. 180' S of EW center line & 1306' W of E line.

SE 33 14N-20E (NWNESE) (2462) (2670NSL; 1306WEL)

ELEV. 6000' ground
6011' Kelly bush

CONTRACTOR

Dunlap and Graham, Long Beach. Harry Failing, tool pusher

COMM.

March 7, 1949

COMP.

June 5, 1949

T.D.

3734'

I.P.

P & A

FORMATION RECORD

(see reverse side)

CASING

0-4' 20" conductor
4' is below cellar floor.

ACID

SHOT

REMARKS Drill stem test 1678'-1742' in Ft. Apache series of Supai formation. Air blow for 18 minutes, some smell of distillate. Good shut-off.

Adjoining water well TD 583', water sand from 555'-565', water raises to 545', makes about 10 gpm. No sample for analysis taken but water is potable.

(SCOUT REPORTS ON REVERSE SIDE)

no permit

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- Hole 20' off vertical at 3400'.
- 4 feet of 20" conductor casing set at bottom of cellar; bottom of the 4' is 21' below kelly bushing, elevation 6011'.
- to 60' 16" hole
- 60 - 1918' 11" hole
- 1918 - 3731' 9 5/8" hole
- 3731 - 3734' 7 5/8" hole (core hole).

Well plugged from 750'-650' in hard shale

County Navajo
Area Hunt
Lease No. _____

Well Name Lockhart #1 Aztec
Reworked by KW Oil Co. in 1950. (Kelly-Weast)
Location NW NE Sec 33 Twp 14 N Range 20E Footage 180' S of quarter Sec
LS NW NE SE Spud _____ Completed _____ Total line _____
Elev 6012 Gr 6020 KB Date 3-7-49 Abandon 6-3-49 Depth 3734
6020' from HSGS 7 1/2' aquifer Approx. _____
Contractor: Record Russell per C & D Cost \$ _____

Drilled by Rotary ☒
Cable Tool _____

Casing Size _____ Depth _____ Cement _____

Production Horizon _____

Initial Production D&A

BTU Valve 357 + 372 on different analyses

D. M. Ferebee (Stanaland) on this well almost continuously

REMARKS	Spud	Coconino	Dst in Ft.	Apache
	Supai	450		blow air 18 min.
	Redwall	3650		Some smell of distillate
	Pre-Camb	3724 (+ 2296)		Good shut-off

Apparently only zone tested is 1635'-1735' which made some flammable gas with 70% Nitrogen.

Elec. Elec Log (Relined log file - Reel, Dec) Sample Log Am Strat #133-R
Logs _____ Sample Descrip. X
Applic _____ Completion _____ Sample Set 7-39, 8-37, 554
to Plug _____ Record _____ Report _____ Cores analysis X
in file

Water well - accepted by _____

Bond Co. _____
& No. _____

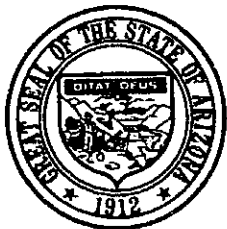
Bond Am't \$ _____ Cancelled _____ Date _____
Organization Report _____

Filing Receipt _____ Dated _____ Well Book _____ Plat Book _____
Loc. Plat _____ Dedication _____

PERMIT NUMBER none

Date Issued _____

#9-3



Fife Symington
Governor

State of Arizona
Arizona Geological Survey

416 W. Congress, Suite 100
Tucson, Arizona 85701
(520) 770-3500



Larry D. Fellows
Director and State Geologist

December 1, 1995

Ms. Elizabeth Coffman
Dwight's EnergyData, Inc.
4350 Will Rogers Parkway, Suite 101
Oklahoma City, OK 73108

Dear Elizabeth:

The information you requested from our files 9-3, 13-1, 6, 14, 156, 372, 883, and 884 is enclosed. The Ridgeway wells (883 and 884) are still in confidential status. I can say, however, that the 3-1 (884) was drilled about 4 miles south of the Ridgeway/Canstar #1 Plateau Cattle ((880) which was also reported as a CO₂ discovery. Ridgeway has not yet proposed a name for this apparent CO₂ field.

As I have noted before, information in some of the earlier well files is sometimes quite meager.

Let me know if I may be of further assistance.

Sincerely,

A handwritten signature in cursive script that reads "Steven L. Rauzi".

Steven L. Rauzi
Oil & Gas Program Administrator

Enclosures

TO: Steve Rauzi STATE AZ
FROM: Elizabeth Coffman in Oklahoma City OK

QTR SE NE
FOOTAGE 2720 N 1300 W
OF SE 1/4 Cor ↑

____ See reverse for my request. *Wrong*
 ____ Drill Stem Tests
 ____ Log Tops
 ____ Core Description
 ____ Geological Report or Well Resume
 ____ Completion Report
 ____ Plat
 ____ Application to Drill
 ____ Sundries - location change
 ____ Sundries - Perfs & trtm
 ____ API # 02-017-05011
 ____ Permit # 9-3
 ____ GR Elevation
 ____ KB Elevation
☒ Entire Wellfile
 ____ Other

RESEARCHER'S COMMENTS:

[illegible]



Division of Helium
Resources

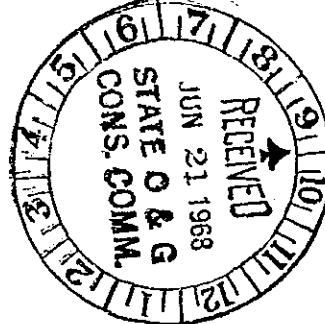
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Helium Activity

June 19, 1968



P. O. BOX 10085
AMARILLO, TEXAS 79106



Arkansas-Louisiana Exploration Company
P. O. Box 669
Holbrook, Arizona 86025

Gentlemen:

Enclosed are two copies of a report on the analysis of a gas sample that was analyzed as part of the Bureau of Mines survey for helium-bearing natural gases. The sample was obtained from your Lockhart Aztec No. 1 well located in Section 33, Township 14 North, Range 20 East, Navajo County, Arizona.

The Bureau of Mines Helium Activity at Amarillo, Texas, provides a current file on analyses of natural gases, which is open to public inspection. In addition, the analyses are published periodically in Bureau of Mines information circulars and bulletins. We would like to obtain permission to utilize the enclosed data for the foregoing purposes along with similar data released by other operators. It will be appreciated if you will sign the "Permission for Release" on one copy of the report and return it to us. A preaddressed envelope, which requires no postage, is enclosed. If you desire permission to publish or circulate the analytical results, please contact us.

To be sure that the well data are accurate, please check the data on the report of analysis and indicate in the appropriate space whether they are accurate without correction or as corrected on the sheet. If the data sheet is not complete, please supply the missing information.

We wish to thank you for your cooperation in furnishing us with samples of gas for analysis.

Sincerely yours,

SIGNED

B. J. Moore, Chief
Branch of Helium Resources Surveys

Enclosure
cc:

✓ Mr. Jim Scurlock, Oil and Gas Conservation Commission
State of Arizona, Room 202, 1634 West Adams
Phoenix, Arizona 85007

STATE of ARIZONA
OIL and GAS CONSERVATION COMMISSION
CAPITOL ANNEX
ROOM 202
1624 WEST ADAMS STREET
PHOENIX, ARIZONA

COMPANY L.M. Lockhart v DATE August 24, 1964
RE: WELL NAME & NUMBER: Lockhart Babbitt #1 and Lockhart Antec #1
LOCATION: SECTION 21 TWP. 27N R. 9E COUNTY Coconino
 33 14N 20E Navajo
FILE NUMBER None

Gentlemen:

We have reviewed our files and find that we need the below checked item (s) in order to complete same. Will you please fill in the enclosed form (s), at your earliest convenience, and return them to this office. May we remind you that your bond (# Not Applicable),

issued by Not Applicable) can be forfeited for failure to comply.

In addition we request a copy of any log run on this (these) well (s).

Your cooperation is appreciated. If we may be of service to you please advise.

Yours very truly,

Bill Cooper

Bill Cooper
Records Section

Completion Record ☒

Plugging Record ☒

Well Log
cc/Bonding Company

Application to plug and abandon

October 10, 1962

Mr. R. D. Munnerlyn, Chief
Branch of Engineering
Bureau of Mines
Helium Activity
536 Petroleum Bldg.
Amarillo, Texas

Re: Gas Analysis
Sec. 33-T14N-R20E.
Navajo County, Arizona

Dear Mr. Munnerlyn:

Attached find Report of Analysis request signed by Mr. Lynn Lockhart who incidentally is one of our Commissioners. He did not know I sent the sample but of course is pleased.

Thanks very much for the analysis and for the bottles you sent me. I received ten tubes.

Sincerely,

JOHN K. PETTY
Petroleum Geologist

JKP:and

Encl.

No permit

September 13, 1962

Director
United States Bureau of Mines
Helium Activity
P. O. Box 911
Amarillo, Texas

Re: Lockhart #1 Aztec - NW NE SE Sec. 33, T14N, R20E,
Navajo County, Arizona

Dear Sir:

I'm sending samples of gas of the above well by separate mail in your own containers. I borrowed the containers while a consultant in Farmington, New Mexico.

Please send us information on the Helium content of these samples as early as you can. A quantitative test is being run on the gas from this well in your Laramie Laboratories.

The commissioners of the Oil and Gas Conservation Commission requested me to obtain helium sample containers for around 10 different wells or horizons so if you'll send me ten sets of 2 bottles each, I'll appreciate it.

Also, they wish for me to obtain larger containers for sampling hydrocarbon gas. I don't know where I can obtain these (about 1 - 1½' in diameter by 3' long with openings at each end). If you can give me some information on where to obtain them, I will appreciate it.

The output of gas in this well is too small to measure with very small pressure and dissipates quickly so I have no potential or pressure information on it.

Yours truly,

John K. Petty
Petroleum Geologist

Director
United States Bureau of Mines
Helium Activity
P.O. Box # 911
Amarillo, Texas

RE: Lockhart #1 Artes
NW NESE Sec 33-T14N-R2DE
Navajo Co., Arizona

Dear Sir:

In sending samples of gas of the
above well by separate mail in your own
containers. I borrowed the container while a
consultant in Farmington, New Mexico.

Please send us information on the Helium
content of these samples as early as you can.
A Quantitative test is being run on the gas
from this well in your ~~Laramie~~ Laramie
Laboratories.

The Commissioners of the Oil and Gas
Conservation Commission requested me to obtain
Helium sample containers for around 10 different
wells or springs so if you'll send me ten sets
of 2 bottles each, I'll appreciate it.

Also they wish for me to obtain ~~the gas~~

larger containers for sampling
Hydrocarbon Gas. I don't know where
I can obtain these (about 1-1½' in diameter
by 3 ft long with openings ~~in the ends~~ at each end).

If you can give me some information on where to
obtain them, I will appreciate it.

The output of gas in this well
is too small to measure with very
small pressure and ~~therefore~~ dissipates
quickly so I have no potential or pressure
information on it.

Yours Truly
John P. Pethy
Petroleum Geologist

of 2/11

June 13, 1951

Mr. W. H. Weast
R-W Drilling Company
214 N. Central Avenue
Phoenix, Arizona

Dear Hubert:

Our files do not contain a copy of the gas analysis mentioned by you. George Greager has shown me an analysis which is very high in nitrogen.

Do you think it might be wise to have this analysis checked by some independent laboratory?

Very truly yours,

L. A. Heindl
Geologist

LAH/mw1

No permit

January 18, 1951

Mr. W. H. Heast
K-W Drilling Company
211 N. Central Avenue
Phoenix, Arizona

Dear Hubert:

We would like to close our 1950 files on the
K-W - Aztec #1, but find that we have not received
any monthly reports of operations from you for
the months of September, October, November and
December, 1950.

We would like to have a short summary of any
activities at the well during that period.

Best regards.

Very truly yours,

L. A. Heindl
Geologist

LAH:ld

1/20 perm

January 18, 1951

Mr. W. H. Weast,
K-W Oil Company,
214 North Central Avenue,
Phoenix, Arizona.

Dear Mr. Weast:

The State Land Department has prepared the enclosed recapitulation of exploratory drilling in Arizona during the years 1949 and 1950.

This information is prepared from what is considered reliable sources, but we would appreciate your bringing any errors to our attention.

Very truly yours,

L. A. Heindl,
Geologist

LAH/lec
Encl.

No permit



OFFICE OF
State Land Department

STATE OF ARIZONA
Phoenix, Arizona

January 18, 1951

W. W. LANE
STATE LAND COMMISSIONER

Mr. W. H. Weast
K-W Drilling Company
214 N. Central Avenue
Phoenix, Arizona

Dear Hubert:

We would like to close our 1950 files on the
K-W - Aztec #1, but find that we have not received
any monthly reports of operations from you for
the months of September, October, November and
December, 1950.

We would like to have a short summary of any
activities at the well during that period.

Best regards.

Very truly yours,

L. A. Heindl

L. A. Heindl
Geologist

LAH:kb

4/21/51

*Dear Leo -
Sorry But Somehow this letter just
received -*

Well closed as of Sept. 9 - 1950.

*On Mar - 27 - 51 I put a gauge on the well
had 52 lb pressure - open 30 min pressure 30 lbs.
Closed until April - 3 - 51 - pressure 53 lbs - also found
Valve leaking - Also gas coming up outside too fast
1770 Permitt Best - as always. Hubert Weast*

August 15, 1950

Mr. J. M. Kellogg
K-W Oil Company
214 N. Central
Phoenix, Arizona

Dear Mr. Kellogg:

The July monthly report of drilling operations (Form O. & G. No. 3, Lessee's Monthly Report) due in this office by August 6, 1950, has not yet been received. The necessity of forwarding this information was brought to your attention in a letter dated June 21, 1950.

We would like to remind you that this report is due, regardless of what the current operations may be, until such time as the drilling permit is terminated.

Very truly yours,

W. W. Lane
State Land Commissioner

LAH:WWL:bm

No permit

June 21, 1950

Mr. J. H. Kellogg
K-W Oil Company
211 N. Central
Phoenix, Arizona

Dear Mr. Kellogg:

As of July 1, 1950 the State Land Department will require monthly reports of operations of oil and gas drilling activities in compliance with Section 6 of the operating regulations governing oil and gas drilling permits in the State of Arizona.

The form of the report will be Form O. & G. No. 3, Lessee's Monthly Report of Operations, copies of which are enclosed. Only one copy *two copies* will be required by this office, printed notice on the form to the contrary. The report is required for each calendar month and is due the 6th of the succeeding month. Section 6 states, "The report * * * constitutes a general summary of the status of operations on the property, and whatever such status may be, the report must be submitted each month until the permit or lease is terminated."

Specifically, the following items of information will be entered:

- 1) Total depth.
- 2) Shutdowns, length of and reasons for.
- 3) Tests, type of and dates.
- 4) Any other noteworthy information regarding operation.

The first report is due August 6, 1950 covering operations from July 1st to 31st, 1950.

An acknowledgment of this letter is requested.

Your cooperation in this matter will be appreciated.

Very truly yours,

W. W. Lane
State Land Commissioner

WWL:IAH:kb
encls.

Up to permit



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Box 2270, Tucson, Arizona

3 April 1950

Mr. W. W. Lane
State Land Commissioner
Phoenix, Arizona

REC-1
APR 4 1950
STATE LAND DEPT.
OF ARIZONA

Dear Mr. Lane:-

The impending Kellogg-Weast test of the Lockhart-Astec #1 well in the vicinity of the town of Snowflake was discussed with Mr. R. D. Gushman and time will be made available for me to attend the testing. I spoke to Mr. Kellogg on Saturday, 1 April 50, and he expects the test to take place this week. He promised to notify me direct.

After the test I plan to visit the Kipling and Cozona wells before seeing you in Phoenix. The Cozona well is a new one, about 30 miles northeast of Flagstaff and I have no information other than that they are drilling below 500'.

I presume that you will be notified when the test will take place and I believe it would be a good idea to remind Mr. Kellogg or Mr. Weast of their promise to get in touch with me. They might be somewhat excited at the time and be apt to forget certain details.

Very truly yours,

L. A. Heindl
L. A. Heindl

No permit

Copy

O. A. LARRAZOLO, JR.
Petroleum Geologist
Phone 2-8459 254 Korber Bldg.
Albuquerque, N. M.

September 6, 1949

Mr. W. H. Weast
513 W. Latham St.,
Phoenix, Arizona.

Dear Sir:

Pursuant to your request made through Mr. D. M. Ferebee, of the Stanolind Oil and Gas Co., I went to Winslow, Arizona on August 28th., and there, through the courtesy of Mr. Ferebee, examined cores, logs, laboratory tests, etc., from the Lockhart No. 1 Aztec Well drilled in section 33 T 14 N R 20 E., Navajo County, Arizona. I returned to Albuquerque the same afternoon bringing with me all the documentary evidence concerning the Well which was kindly furnished me by Mr. Ferebee.

Although time has not permitted an examination of the area in which the Well was drilled it is evident from structure maps and regional geology that the test was drilled on adequate geological structure. The stratigraphy of the area as described by Mr. Charles S. Lavington in his report of the region and by Mr. Ferebee personally to me, coupled with the structural features as mapped, certainly merited the test. The results of the Lockhart No. 1 Well amply confirmed the opinions of these two gentlemen.

The Well started in the Coconino sandstone of Permian age. The succeeding underlying formations were topped at the following depths:

Supai formation	550 ft.
Fort Apache Zone of Upper Supai	
(from samples)	1540 "
(from Electric Log)	1520 "
Bottom Fort Apache	1750 "
Middle Supai	2160 "
Lower Supai	2480 "
Intra-formations conglomerate	3015 to 3024 ft.
Pennsylvanian formation	3024 ft.
Mississippian	3650 "
Devonian	3685 "
Total Depth	3734 "

It is hardly necessary to describe the log of the well in detail. The important features of the Well are the zones which the core analyses, electric log, solubility tests, etc., are worthy off further treatment to test the possibility of oil and gas production.

There are three potential oil and gas horizons indicated by these tests, as follows: _____

The permit

Zone 1. The electric log picked up the top of the Fort Apache zone of the upper Supai formation at 1520 ft. from 1520 feet to 1628 feet the cuttings showed oil stains-this section was not cored. From 1678 to 1741, a thickness of 63 feet, the section was cored and a core recovery of 100% was obtained. The core analysis of this section, copy of which you have, shows a dolomitic limestone with a weighted average porosity of 3.5%; average oil saturation of 32.6% and 70% solubility in acid. Permeability tests indicated a high capacity of the section.

Zone 2. From 3150 to 3600 feet there is a zone the upper part of which consists of lime showing only minor fractures with local zones of saturation. From 3452 to 3513 feet laboratory tests indicate a saturation of from 0 to 12.8% and a solubility in acid of from 57% to 92%, with an average of 70%. From 3513 to 3600 feet alternating shales, limestones and sandstones show minor fracturing and a small saturation in the cores.

The whole zone, an aggregate of 400 feet may be worth a test in future wells if contemplated tests in the Lockhart No. 1 Well are successful. In this well however, the zone does not seem of enough importance to justify the cost of a thorough test.

Zone 3. From 3610 to 3640 feet a brecciated, hard, red, gritty conglomerate, in which no core recovery was obtained, may contain major fracturing.

From 3657 to 3685 feet the core analysis shows continuous oil saturation ranging from 3.6% to 41.4% and a solubility in acid of from 76.5% to 89.5%. Effective porosity of this zone ranges from 1.1% to 5.5% and major fracturing is plainly visible.

From 3685 to a depth of 3708 feet core analyses indicate oil saturation of from 0 to 14.5% with a weighted average of 9.6%; solubility in acid of from 38.9% to 89.4% and the greater portion of the zone averaging better than 74.3%.

The high porosity and saturation indicated by core analyses in zones 1 and 3, together with the high solubility of the formations in each zone and the presence of major fracturing give these two zones a high potential value as oil and gas horizons. With modern methods of well completion and development no Well having the indications shown by this well should be abandoned without a proper treatment with acid and, as indicated in this case, implemented by shooting to loosen the formation and make it more susceptible to acid.

From the foregoing facts it is obvious that acidizing offers excellent possibilities of developing commercial production of oil and gas in at least two horizons in the Lockhart No. 1 Well. It is therefore recommended that after drilling out the plug and cleaning the well the following steps be taken:

Zone 3.

It is suggested that 5½ inch casing be set at 3605 feet and cemented with at least 250 sacks of cement and preferably 300 sacks. It is then desirable to shoot the formation with 250 quarts of nitro-glycerine. The well should then be thoroughly cleaned out and a production test made. If the shot fails to develop commercial production of oil or gas it will serve to form lines of fracturing in a deep zone surrounding the bore hole which will permit the acid penetrate deeper. This should be applied in

the permit

at least two and preferably three stages. The first should be no more than 1000 gallons. After that the Well should be thoroughly cleaned out and a production test made. The second stage should be with 3000 gallons. If a third stage is necessary then 10,000 gallons should be applied, cleaned out and tested.

Zone 1.

This zone, from 1520 to 1741 feet, is also a most attractive one. If zone 3 should fail to develop into a commercial zone after acid treatment the same procedure should be followed with zone 1.

After recovering as much casing as possible above the cemented section a bridge plug should be set at 1750 feet. The casing should be set at 1520 feet and cemented with 250 sacks of cement. There will then remain 230 feet of open hole which should be shot with 350 quarts of nitro-glycerine, cleaned out and tested. If results are negative or unsatisfactory then a three stage acid treatment should be applied with the first stage being 1000 gallons; the second 5,000 gallons and the third if necessary not more than 10,000 gallons. It is important that the well be cleaned out and tested after each stage. Then if the results of any one stage are satisfactory the others can be eliminated.

Even should the results of the third and deepest zone prove satisfactory it may be found desirable to treat the zone 1 interval. In such case the casing should be perforated with from 300 to 400 perforations opposite the interval from 1520 to 1741 feet. Then the recommended acid treatment should be applied. Shooting, of course, would be eliminated in such a case.

Although carbonaterocks, such as limestones, are not all equally soluble in acid, where properly applied, the acid produces amazing results even where the formations have had barely a color of oil or a faint gas odor while drilling. Acid enlarges the pores and creates cavities in limestone, especially where major fracturing exists. The deeper the acid penetrates the formations away from the bore hole the greater the outlets, or pores, become permitting a freer flow of oil and gas. Hence the advisability of acidizing in two or three stages, each stage with a greater amount of acid than the preceding one.

It is not possible to estimate the amount of oil or gas that acid treatment will develop on relatively similar formations in widely separated areas. Comparisons may prove unsatisfactory. In order to point out what the proper application of acid can do, however, it may not be amiss to cite the development of a well in the Boundary Buttes area or northeastern Arizona and southeastern Utah which is now producing from Hermosa limestone the geological equivalent of the formation in the lower zone of the Lockhart Well.

NW $\frac{1}{4}$

Byrd-Frost's English No. 1, located in C NE $\frac{1}{4}$ Section 22 T 43 S R 22 E., San Juan County, Utah, topped the Hermosa formation of the Pennsylvanian at 3790 feet. The lime core showing gas and oil. Laboratory tests of the core did not show good porosity. A drill stem test, however, from 4625 to 4677, open 1 $\frac{1}{2}$ hours, had gas at the surface in ten minutes estimated at 250,000 cubic feet per day.

The zone was treated with acid through 200 perforations in the casing. The first stage of 1,000 gallons did not produce any additional gas. The second treatment with 2,000 gallons increased the flow of gas to from eight million to ten million cubic feet per day. The last stage of 10,000 gallons developed the flow of gas to an actual measurement of 20 million cubic feet per day. At the time of completion it was also making a small amount of high gravity oil.

Laboratory tests of the cores from the two horizons mentioned above in the Lockhart No. 1 Well indicate that the three stage acid treatment recommended has better than an average chance of developing commercial production. Both zones are equally important and both should be tested, zone No. 1 even if the acid has to be applied through casing perforations.

Respectfully submitted,

O. A. Larrazolo, Jr.

Number 4 A PG, 1956

no permit

12. 5000-
13

9-3

Report to Messrs. J. M. Kellogg and W. H. Weast,

Phoenix, Arizona

8-17-47

L. M. Lockhart

- I SUBJECT: Stratigraphic geology of L. M. Lockhart, No. 1 Aztec Well,
Sec. 33, T 14 N, R 20 E, Navajo County, Arizona, Elevation 6011 ft.
- II INTRODUCTION TO STRATIGRAPHIC COLUMN AT WELL: The following
condensed description of the geologic strata represented has
been compiled from the log of Stanolind Oil and Gas Company
and from examination of well cores and samples.

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
0	Sandstone, white, quartzitic, fine-grained	<u>Coconino</u>
550	Shale, red brown, silty, calcareous, in sandstone	<u>Supai</u>
620	Anhydrite and gypsum in shale	
820	Sandstone, alternating with gypsum, anhydrite, halite	
1070	Shale, gray and brown, silty, dolomitic, massive	
1110	Anhydrite, mottled to white, hard, dense	
1140	Halite, grading down into anhydrite and shale	
1250	Shale, gray brown, calcareous	
1270	Shale, red brown, halite inclusions; grading down to anhydrite, halite, sandstone, red shale	
1540	Dolomite, dark gray to black, silty, some black organic matter	<u>Fort Apache</u>
1570	Shale, gray, alternating with dolomite	<u>memb.</u>
1678	Dolomite, brownish gray	<u>Base Ft. Apache</u>
1750	Shale, red brown, dolomitic	
1770	Halite, with beds of sandstone and anhydrite	<u>Base Up. Supai</u>
2160	Anhydrite, gray, massive with halite	
2175	Shale, red to chocolate brown, sandy, includes gypsum and minor beds of sandstone	
2620	Shale, gray, highly micaceous, dolomitic	
2755	Dolomite, brown to gray brown, silty	
2780	Shale, gray, dolomitic, and some dolomite	
2860	Limestone, gray brown, shaly, dolomitic, with minor streaks of brown, calcareous shale	
2904	Shale, brown, calcareous, hard, dense; some gypsum	

✓
no permit

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
2930	Shale, brown, calcareous; streaks of brown limestone	
2938	Limestone, cherty, hard, silty, interbedded with calcareous, mottled green shale	
2995	Shale, brown, calcareous, fractured, with anhydrite inclusions	
3015	Limestone conglomerate; smooth brown limestone pebbles in lime matrix	Base of Middle Supai //
3020	Shale, blue gray, calcareous, silty	
3040	Shale, brown, calcareous, small lime pebbles	
3090	Limestone, brown, silty, some fractures	
3107	Shale, brown, calcareous	
3121	Limestone, gray, very shaly	
3127	Shale, brown, calcareous	
3132	Limestone, dark gray, silty	
3138	Shale, brown gray, calcareous	
3141	Limestone, gray, very silty, nodular	
3147	Limestone, aphanitic, gray, cherty, fractured	
3156	Shale, dark brownish gray, calcareous	
3166	Limestone, gray, silty, cherty	
3175	Shale, dark gray to black, fossiliferous, calcareous, with minor fractures	
3184	Limestone, gray, massive, coarse grained, fossiliferous	
3216	Shale, micaceous, silty, calcareous; minor fractures	
3273	Shale, gray, silty, bentonitic, calcareous, with lime pebbles	
3296	Limestone, gray, alternating with gray shale	
3385	Shale, mottled, red brown, calcareous, nodular, and limestone, thin, granular shaly	
3424	Limestone, gray, granular, silty, fossiliferous; some chert, minor fractures	
3471	Sandstone, very fine grained, fractured, calcareous	
3479	Limestone, gray, cherty, granular, minor fractures; grades down into shaly limestone	
3505	Shale, red brown, calcareous, micaceous, with beds of fossil limestone	
3539	Sandstone, dark gray, hard, fine-grained, with purple shale partings	
3544	Limestone, light gray, coarse-grained, silty, with shaly partings and gray brown nodular shale	
3575	Shale, red brown, calcareous, fossiliferous	
3610	Shale, red, silty, mottled, with subangular granite fragments	
3641	Sandstone, very shaly, fine to medium-grained, calcareous; some limestone inclusions	

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
3650	Limestone, dolomitic, silty, massive, with minor fractures	<u>Pre-Cambrian</u>
3657	Limestone, dolomitic, granular, sandy, with vugs of white crystalline limestone, major fractures	
3685	Limestone, dolomitic, gray green, with thin gnarly beds of sandy shale	
3708	Sandstone, fine-grained, calcareous	
3724	Granite, biotite, weathered	

III AGE OF STRATA AND RELATION TO SEDIMENTARY BASIN: Most, if not all, of the sedimentary strata encountered in the well are of Pennsylvanian and Permian age. Pre-Cambrian granite was encountered at the bottom and a small thickness of Devonian and Mississippian strata may possibly rest upon it, though the writer believes that Pennsylvanian beds extend down to the granite. It is important to note that this well is located on the margin of a basin of Pennsylvanian age and near the center of the deepest basin of Permian age (3200 feet) in Arizona.

IV ZONES THAT SHOW OIL CONCENTRATIONS: According to core analysis by Stanolind Oil and Gas Company the following zones were found to contain oil (Analyses made by research department in Tulsa) as per attached enclosure.

1678 - 1741
2873 - 3129
3175 - 3449
3452 - 3515
3657 - 3708

<u>Feet to Top</u>	<u>Rock Description</u>	<u>Formation</u>
3650	Limestone, dolomitic, silty, massive, with minor fractures	
3657	Limestone, dolomitic, granular, sandy, with vugs of white crystalline limestone, major fractures	
3685	Limestone, dolomitic, gray green, with thin gnarly beds of sandy shale	
3708	Sandstone, fine-grained, calcareous	
3724	Granite, biotite, weathered	<u>Pre-Cambrian</u>

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1678 - 1741
2873 - 3129
3175 - 3449
3452 - 3515
3657 - 3708

V ZONES OF POROSITY AND HIGH RESISTIVITY FROM ELECTRIC LOG;

An electric log prepared by Schlumberger Well Surveying Corporation (see attached) indicates the following:

- (1) Porous zone in limestone with high resistivity from 1510 to 1730 feet.
- (2) Various zones of porosity and high resistivity in limestone indicated between 2873 and 3565 feet.
- (3) Zone in limestone between 3657 and 3708 indicates a porous zone of high resistivity related to area of major fracturing observed in the cores.

VI ZONES OF OBSERVED FRACTURE: According to D. M. Ferebee, who was geologic observer for Stanolind Oil and Gas Company, the following zones of fracture in limestone were noted.

- (1) Minor fracturing in limestone 1678 - 1741 feet.
- (2) Minor fracturing in limestone and shale 2873 - 3515 feet.
- (3) Major fracturing in limestone 3657 - 3704 feet.

VII GENERAL CONCLUSIONS: Most favorable zone for testing, based on field examination of cores and cuttings, on Schlumberger log of well and on lab analysis of core appears to be between 3600 - 3708 feet. A second favorable well for testing is indicated between 1510 and 1730 feet. Should a successful completion be made in either or both of these zones, further testing would seem to be warranted in the porous sections of the zone between 2873 - 3565 feet.

VIII INCLOSURES:

- (1) Slumberger detail log of Lockhart No. 1 Aztec Well.
- (2) Slumberger general log " " " " "
- (3) Core analysis summaries " " " " " by
Stanolind Oil and Gas Company.

Report submitted August 27, 1949

Edwin D. McKee

Edwin D. McKee,
Geologist

Postoffice Box 554
Flagstaff, Arizona

No permit

VIII INCLOSURES:

- (1) Slumberger detail log of Lockhart No. 1 Aztec Well.
- (2) Slumberger general log " " " " "
- (3) Core analysis summaries " " " " " by
Stanolind Oil and Gas Company.

Report submitted August 27, 1949

(signed) Edwin D. McKee,
Geologist

Postoffice Box 554
Flagstaff, Arizona

No permit

August 5, 1949

Mr. L. A. Heindl
Rt. 5, Box 241
Tucson, Arizona

Dear Mr. Heindl:

I enclose the costs of shooting and acidizing the well.

Mr. Ferabee obtained these ^{standard} prices for us and all prices are exact excepting the rent of the well rig. That is on a per day basis. The job should be done in ten days but we based our figures on fourteen days.

We hope to have our application ready to file this coming week.

Hope the moving didn't get you down. This heat has been terrible.

Thanking you for your assistance and with best wishes,
I am,

Sincerely yours,

W. H. Weast
W. H. Weast

WHW/1k
1 encl.

*Your report arrived this morning
Thanks a lot. The corporation dept
might want your verification of
costs - so shall enclose our cost
sheet.*

Weast,

No permit

August 5, 1949

Mr. L. A. Heindl
Rt. 5, Box 241
Tucson, Arizona

Dear Mr. Heindl:

I enclose the costs of shooting and acidizing the well.

Mr. Ferabee obtained these prices for us and all prices are exact excepting the rent of the well rig. That is on a per day basis. The job should be done in ten days but we based our figures on fourteen days.

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Weast,

1 no permit

August 3, 1949

Mr. J. M. Kellogg
Mr. W. H. Weast
Phoenix, Arizona

Gentlemen:

At your request the following letter report is submitted regarding your proposal to test the L. M. Lockhart-Astec #1 well on Section 33, Township 14 North, Range 20 East, Navajo County, Arizona:

Geology-Structure

The well is located on the Snowflake anticline which is superimposed on the larger Holbrook anticline. The closure on the Snowflake anticline itself is from 120 to 130 feet and the closure on the Holbrook anticline increases this closure to over 300 feet. The Snowflake anticline covers an area of about 11 square miles. The elevation at the well site is about 6000' above sea level. The structural location of the well was based on a geological report by Mr. Silas C. Brown, formerly with the U. S. Geological Survey and now with the General Petroleum Corporation.

Geology-Stratigraphy

The surface formation at the well site is the Kaibab limestone of Permian age and the well successively penetrated the Coconino sandstone (Permian), the Supai formation (Permian), the Naco(?) limestone (Pennsylvanian), the Redwall limestone (Mississippian) and the Martin limestone (Devonian). The well reached granite at 3724' and bottomed at 3734'.

Drilling History

This well was drilled by L. M. Lockhart of Los Angeles. It was cored almost continuously from 1678' to 2181' and from 2492' to the bottom. Core recovery was nearly 90% and an unusually accurate picture of the encountered formations is available. The Stanolind Oil and Gas Company, on agreement with L. M. Lockhart, had its geologist, Mr. D. M. Ferabee, on the well almost continuously and in addition ran a series of cutting and core analyses. Electric resistivity and gamma ray logs were run after the completion of the well. A drill stem test was run from 1678' to 1742' with negative results. The well was plugged and abandoned without any thorough formation tests being made.

Petroliferous Possibilities

The marine formations of the Permian, Pennsylvanian, Mississippian and Devonian age are all considered as source beds for petroleum because of their high content of organic material. Many small oil shows were encount-

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ered from 1500' to about 3700'. There were also indications of gas and some smell of distillate.

Core analyses prepared by the Stanolind Company laboratories show two zones with petroliferous possibilities: One from 1540' to 1750' and the second from 3590' to 3700'. Both are in "tight" limestone formations, i.e. formations which will give up their petroleum content only upon the application of heavy dosages of acid. The drill stem test run from 1678' to 1742' was in the first possibility mentioned above. It showed an 18 minute blow of air and a strong distillate smell but nothing more. Core analyses of this zone show the porosity and permeability to be low, i.e. "tight", but the oil saturation of the pore space is over 25%. In the second zone, 3590' to 3700', a similar condition exists.

While the formations penetrated in these two sections are admittedly "tight", the percentage of saturation of the available pore space warrants the thorough testing of these two sections with adequate shooting and intense acidization.

The electric log of this well is reported to be very similar to the Dove Creek Field and Boundary Butte Field discovery well electric logs. The discovery well in Boundary Butte Field was initially abandoned as a dry hole because of the "tight" appearance of the limestones. Subsequent shooting and heavy acidization made this an excellent producing well and opened up a new field.

Proposed Development

The following is an outline of the proposed testing of the Lockhart-Astec #1 well:

Both horizons will be tested.

The bottom of the well is to be cemented with 250 to 300 sacks of cement from 3590' to 3710' and then drilled out to 3700'. The well will then be shot from 3590' to 3650' and heavily acidized to make a thorough test.

If the bottom horizon becomes a producer, it is proposed to drill a second well in the immediate vicinity to test the upper horizon between 1540' and 1750' in a similar manner.

If the bottom horizon does not produce, the upper horizon will be tested in a similar manner in the same hole.

The work will be done by reputable firms and supervised by Stanolind Oil and Gas Company representatives.

Comments

In that this well was never shot and acidized, the State Land Depart-

1772 per 1772

- 3 -

ment feels that the Lockhart-Astec #1 well has not yet received a thorough test. The information contained in the core and sample analyses, the electric log, and in both written and oral communication with geologists and production men concerned, emphasizes the fact that there is adequate geologic justification for making a thorough test of the oil and gas possibilities of this well.

The plan of shooting and acidizing the well, as outlined above, is adequate to thoroughly test the petroleum possibilities of the Lockhart-Astec #1 well.

Very truly yours,

L. A. Hsindl
Geologist

LAN:ld

No Permit

May 31, 1949

Mr. T. W. Cabeen
Aztec Land and Cattle Company
P. O. Box 873
Albuquerque, New Mexico

Dear Mr. Cabeen:

Thank you very much for the Stanolind core analysis of the Lockhart-Aztec #1 well. Any further information that you may obtain from time to time regarding this well would also be appreciated.

I was at the well on May 26th and at that time they were drilling in a very hard crystalline limestone of Mississippi appearance. The deepest core at that time was from 3649 to 3657. The limestone was hard and it was difficult to determine whether the fractures were primary or induced. There were a few shale partings. — Miss - AMST.

We are looking forward to seeing you during your visit in Phoenix.

Sincerely yours,

L. A. Heindl
Geologist

LAH:kb

No permit

AZTEC LAND AND CATTLE COMPANY, LIMITED

T. W. CABEEN, Vice-President
ALBUQUERQUE NATIONAL BANK BUILDING
P. O. Box 873
ALBUQUERQUE, NEW MEXICO

May 17, 1949

RECEIVED
MAY 19 1949

STATE LAND DEPT.
OF ARIZONA

Mr. L. A. Heindl, Geologist
State Land Department
Phoenix, Arizona

Dear Mr. Heindl:

My absence has delayed this response to your favor of 12th inst.

Herewith Stanolind core analysis of the 1678-1741 zone of Lockhart-Aztec #1. We have not yet received results of acid response test. Field tests showed fair reaction.

This well was at 3479 at 10:00 a.m. yesterday in black shale interbedded with gray limestone, which sounds like about 100 to 150 feet above the bottom of the Pennsylvanian. From 3178 to 3425, it had intermittent shows (staining, gas bubbles, fair odor on fresh fracture, and dead oil along seams), with considerable evidence of vertical fracture, in a hard, dense, tight dark gray limey formation. The formation responds readily to acid.

I expect to be in Phoenix within the next 30 days, and intend to give myself the pleasure of a visit with you. In the meantime, with kind regards, I am

Sincerely

T. W. Cabeen
Vice President

The permit

May 12, 1949

Mr. T. W. Goben
New Mexico and Arizona Land Co.
245 Korber Building
Albuquerque, New Mexico

Dear Mr. Goben:

Mr. Dorsey Hager told me that you had in your possession a copy of a porosity-permeability-saturation report on the formation tested in the Lockhart-Astec No. 1 well. We would very much like to have a copy of this report for our files and would appreciate your forwarding it to us at your earliest convenience.

It was a pleasure meeting you at the meeting in Albuquerque and I certainly hope that Mr. Lockhart will bring in a well on your property in Navajo County. It would be a great boon both to yourselves and the State of Arizona.

Very truly yours,

L. A. Heindl
Geologist

LAH:kb

No permit